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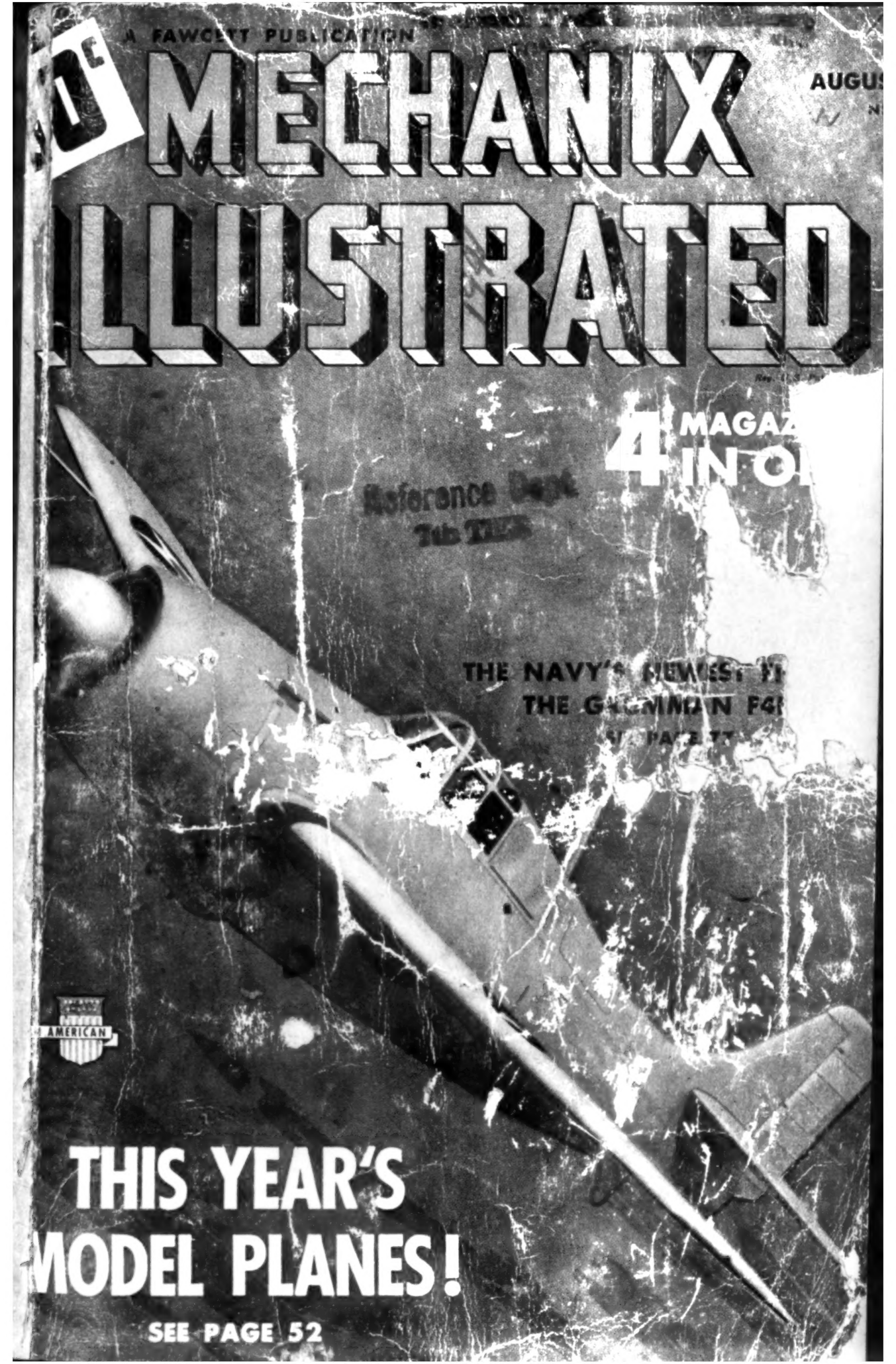

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AUGUST
1940

Volume XXIV
Number 4

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HOW fast?

Ever since that never-to-be-forgotten day at Kitty Hawk, when the Wright Brothers made history, man has followed the paths of planes across the sky and asked himself that question—"How fast?"

In the next issue, we're going to try and answer that question by giving you the predictions of a man who can back his imaginative prophecies with a technical knowledge of aviation that few people in the world can boast.

He's Clarence L. Johnson, chief research engineer of the Lockheed Aircraft Corporation, and if anyone can answer the question intelligently, he's the man to do it!

The How To Build Section will feature the first installment of the boat we've been promising you in the Workbench. She's *Bonnie*, an 18x7 foot shallow draft cabin sloop with a small air-cooled auxiliary engine. Bottom is V type, and marine plywood construction is employed, making her the ideal all-around boat for the amateur boat builder-enthusiast. There will also be an exceptional assortment of interesting feature articles, varied news shorts, and practical workshop projects.

The new MECHANIX ILLUSTRATED is on sale at all newsstands the first of every month.

ROBERT HERTZBERG, Editor

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Why Many Radio Technicians Make $30, $40, $50 a Week

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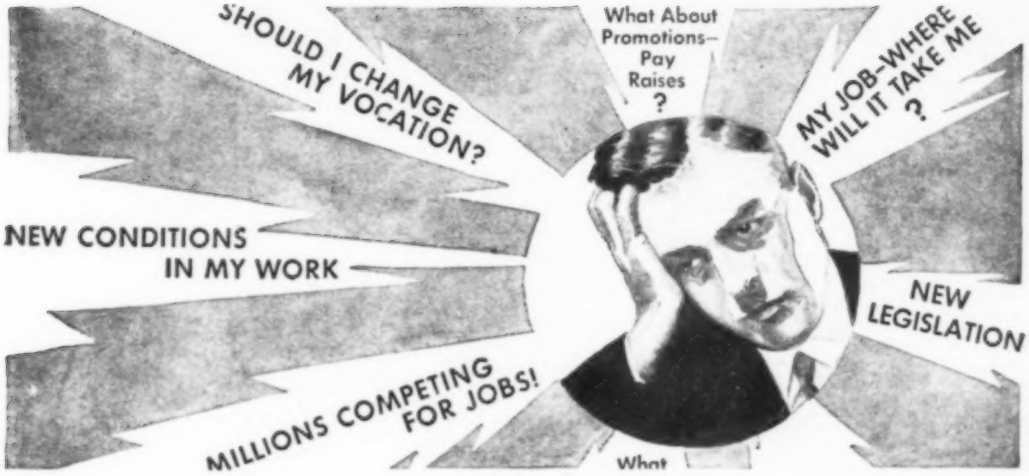

WHERE DO YOU GO FROM HERE?

YOU'RE like a million other men—you're facing a *big* question. The depression turned business topsy-turvy and now the rebuilding period stares you in the face.

Are the things that are happening today going to help or hinder you—what will they mean in your pay check? Where will they put you five, ten, twenty years from now? How can you take full advantage of this period of opportunity?

We believe you will find the answer here—a suggestion the soundness of which can be proven to you as it has been to thousands of other men.

The whole trend today—legislation, spirit, action—is to put men back to work, raise earning and spending power, *give every man a fair chance to work out his own salvation.*

The road to success remains unchanged but, bear this in mind, *what it takes to win is radically different!*

No employer today would dare risk an important post in the hands of a man who had not learned the lesson of '29. Why should he, when right at this moment he can pick and choose and get almost any man he wants at his own price?

Business organizations are rebuilding—reorganizing for the new conditions. Before it is over every man and every method will be judged in the cold light of reason and experience—then dropped, remade or retained. This spells real opportunity for the man who can meet the test—but heaven help the man who still tries to meet today's problems from yesterday's standpoint! Out of the multitude still jobless there are sure to be many frantically eager to prove him wrong and take his place.

Some Men Have Found the Answer

Seeing these danger signs, many aggressive men and women are quietly training at home—are wisely building themselves for more efficient service to their employers.

You naturally ask, "Has your training helped men withstand conditions of the last few years?"

Our answer is to point to a file of letters from many of our students reporting *pay raises and promotions while business was at its lowest ebb*—together with a myriad of others telling of greater success during these recent months of recovery.

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Chips from the Editor's Workbench

Pilot's, Pfd.

"U. S. To Train 50,000 Pilots A Year," the newspaper headlines are shouting. Well, it's about time we woke up, even if it did take a major catastrophe in Europe to blast us out of our blissful sleep. Isn't it strange that the most mechanically- and scientifically-minded nation on earth should be the last to realize that the airplane (an American invention!) has changed every previous concept of war and conquest?

From the personal standpoint of thousands of air-crazy American youths, the new defense program is particularly significant because it radically changes the complexion of our military and naval flying services. Heretofore these have been virtually private clubs, with such terrifically difficult entrance requirements that even the modest peace-time quotas were never achieved. An applicant had to be a sort of combination of Einstein, Marconi and Clark Gable just to get enrolled and he needed the endurance of "Capt. Marvel" to survive the courses of instruction. The lucky graduates of our service schools are probably the best aviators in the world, but there just aren't enough such super-men to meet the country's immediate needs.

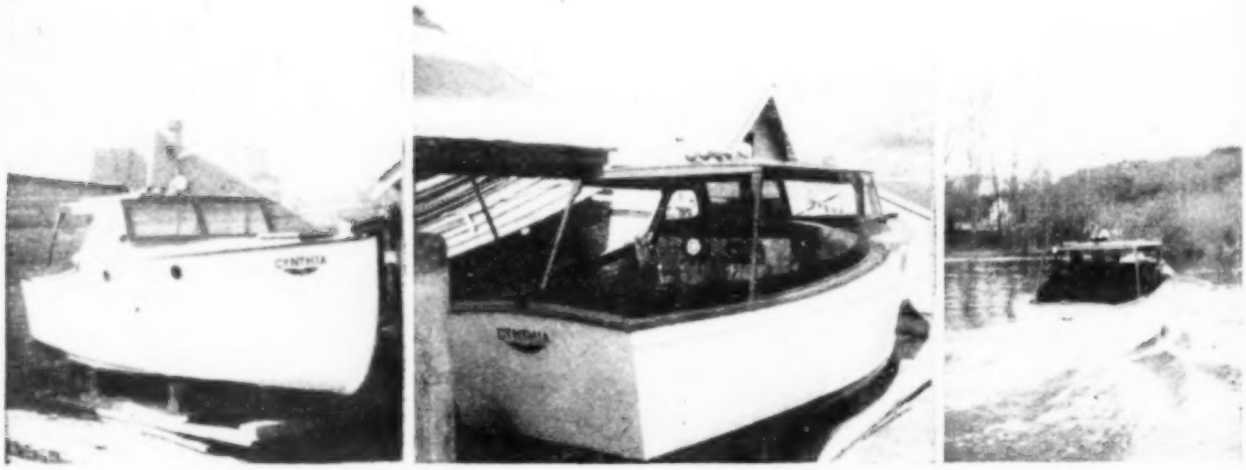
Even the comparatively tame CAA civilian training program, which last year produced 10,000 fledgling fliers, was open only to college students. As I pointed out in the "Workbench" in the April, 1940, issue of MI, this works an unnecessary hardship on many capable and eager young men who, because they have been forced to go to work in shops, garages, factories, etc., through lack of family support, actually have a much better fundamental "ground" training in engines and related mechanical airplane functions than their luckier cousins in the fraternity houses. Some of these lads may not know how to juggle a cup of tea delicately at an officers' social function, but they'll make first-rate fliers, and *that's* what counts when they're balancing bombs instead of bon-bons.

***

Prophets With Honor

The late Brig. General William ("Billy") Mitchell was court-martialled shortly after the World War when he dared to suggest that the

[*Continued on page* 11]



The ability of MI readers to make sturdy, beautiful boats, of all sizes from kayaks to ocean-crossing ketches, never fails to amaze us. Here is a typical example of amateur craftsmanship that we are more than happy to reward with the Workbench first prize of $5.00. The boat is "Kingfisher," a Sam Rabl design, which was described in the No. 4 edition of HOW TO BUILD 20 BOATS, and it was built by C. S. Stapish, 407 Main Street, St. Maries, Idaho. He writes:

"Construction was started on November 15th, 1939 and completed April 19th, 1940. Two days later it did a 36-mile cruise with nine on board; 18 miles up the St. Joe River in 2 hours, 45 minutes, and return in 1 hour, 40 minutes. The boat ran at half throttle or less most of the time, with power supplies by a Model A Ford engine. We sure are pleased with the load carrying and handling ability of this boat."

"Kingfisher" is a 20-foot, V-bottom cruiser. A set of large, professional type blueprints showing all details of construction, is available for $2.00. (Specify plans No. 903 when ordering.) Copies of the No. 4 edition of HOW TO BUILD 20 BOATS cost 50 cents each. Order from Fawcett Publications, Inc., Greenwich, Conn.

Editor's Workbench Chips

[*Continued from page* 10]

Army's flying service was inefficient and that the airplane could lick the battleship. Now, a decade too late, and after his death, he is being sanctified as a prophet as well as a martyr.

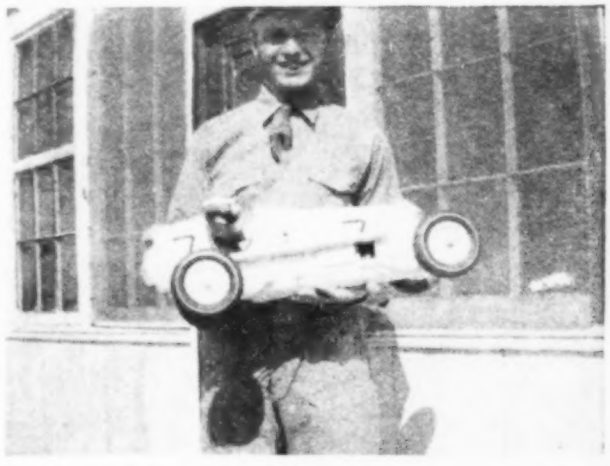
In the May, 1938, issue of this magazine, Brig. General H. H. Arnold emphasized the need for more planes and more men to run them. Today, as Major General Arnold, Chief of the Air Corps, he is fully prepared to handle the tremendous air expansion program the nation has undertaken.

Beginning in the March, 1939, issue of MI, Major Al Williams wrote a series of sizzling articles based on his first-hand experiences in Europe. He flew foreign war planes, and without qualification said the German ships were superior to anything known. He also described the contemplated air-raid technique of the German air force. His predictions have been borne out with sickening accuracy in the present European conflict, yet when the articles first appeared in MI many readers said,

"The wars in Spain and China show otherwise. This guy is nuts. Let him stick to his stunt flying."

Ho, hum. Maybe MECHANIX ILLUSTRATED should be made required reading in the Army's and Navy's staff schools.

[*Continued on page* 12]



This snappy-looking racing car was inspired by the MI "Spitfire," which appeared in the June, 1939 issue and also in the MODEL BUILDER'S HANDBOOK. Writes Curtis Bohn, P. O. Box 237, Mazomanie, Wis.:

"It has an overall length of 25 inches, 18-inch wheel base and 12-inch tread. The frame, body formers and radiator grille are of copper tubing The body was made from three one-gallon anti-freeze cans and the radiator shell from a coffee can. The engine is a ⅓ h.p. job.

"Running in a hundred-foot circle, this car has been clocked at 54 m.p.h. It took about six weeks to build and cost only $3.50 without the engine."

Maybe you can't see it, but there's doll in the front seat, dressed up to look like a racing driver. A $3.00 Workbench award to Curtis for this snapshot.

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Editor's Workbench Chips

[*Continued from page* 11]

"For Peace and Freedom"

That's the slogan of the 1940 New York World's Fair. All is peaceful on Flushing Meadow and the best shows are free. The major changes have taken place in the amusement and foreign areas, which are conspicuously smaller than last year. The major industrial exhibits are still packing 'em in, there are plenty of reasonably-priced eating places, local transportation and housing are well under control and all visitors seem to be enjoying themselves. Don't miss this grand fair.

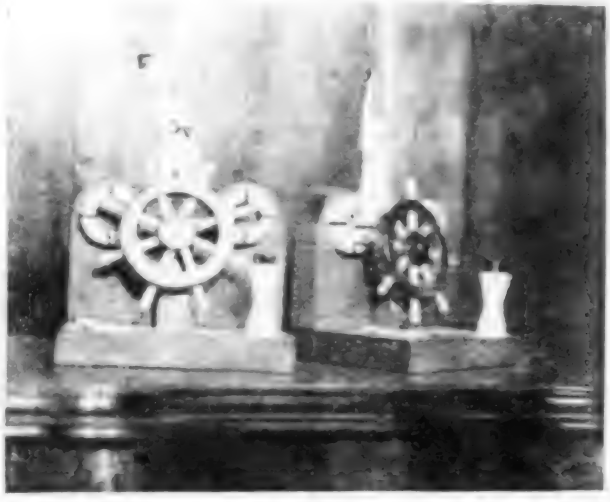
***

Cleaning Up

"I notice that most of the 'Workbench' contributors who make midget cars and power scooters use washing machine motors," writes E. J. Neason, of Brooklyn, N. Y. "Where do they get the things, anyway? Darned if I can pick one up for two or five dollars, as so many readers say they have."

Washing machine motors come from old washing machines and I'm not trying to be funny. City people don't appreciate the fact that large parts of the United States are still without electric power, although the Rural Electrification Administration is running new lines by the thousands of miles. Washing is drudgery no matter where it is done, and women in the rural areas therefore have been willing buyers of washers equipped with small, pedal-starting, long-running, single-

[*Continued on page* 14]

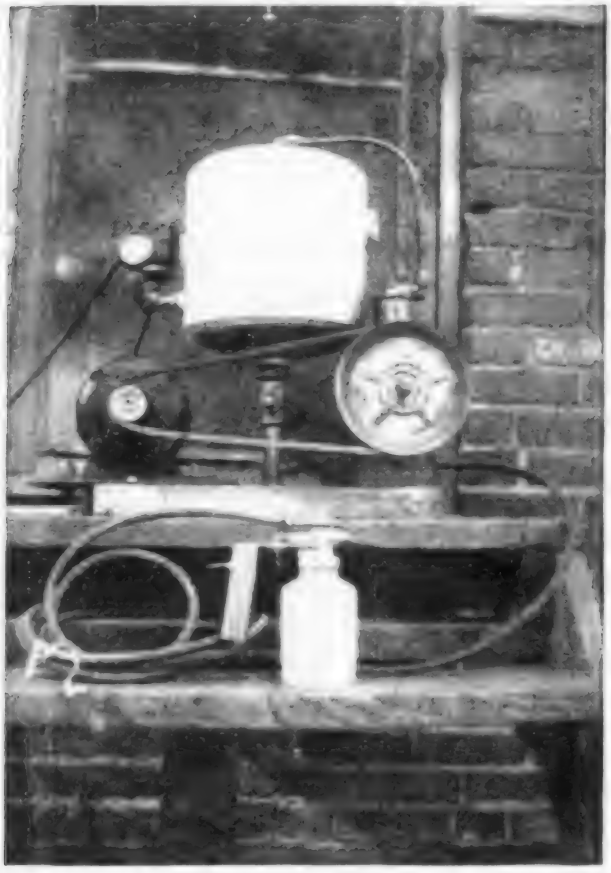


"One Sunday morning I was fooling around the shop and made a miniature ship's wheel," writes Howard L. Swope, 1031 Bilton Way, San Gabriel, Cal. "The more I looked at it the bigger it grew, and eventually it became the pair of book ends shown in the photograph. The actual cost was about twenty cents. Several of my friends liked them so well that they wanted me to raffle them off. I did, and made $7.00 on the deal! I have sold other sets for $2.00 each."

For an accountant, Mr. Swope is certainly a good craftsman. He rates a $3.00 Workbench prize for this interesting contribution.

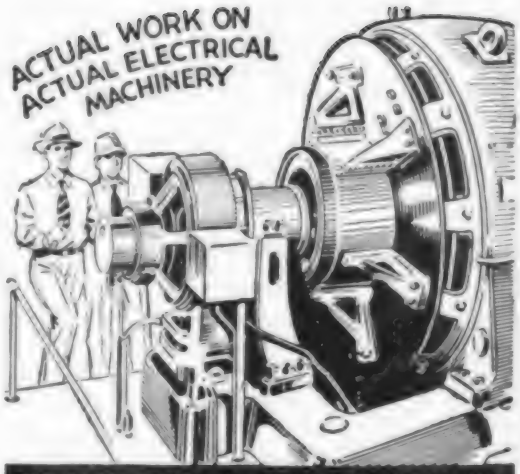
Editor's Workbench Chips

Here are some more examples of readers' handicraft. Why not send in pictures of *your* projects? See page 17 for details.



"I am sending you a photo of a paint spray outfit that I constructed during my spare time. It has an automatic shut-off gauge and switch and a welded steel tank which will withstand 200 lbs. pressure. The ¼ h. p. motor and twin cylinder compressor were obtained at a junk yard. The total cost of the outfit was about $17.00. At the present time I am building an arc welder from an old 32-volt Delco light outfit and will send you a photo when it is finished." This letter, and the picture above, are from Percy E. Tichenor, 1410½ 16th Avenue, Moline, Ill., and wins him a $3.00 Workbench check. We'd like to see the arc welder, and we know that many other readers will be interested also.

Nothing like getting an early start! Here is a neat little eight-foot rowboat built by Eugene Eroh, 371 Hudsondale Street, Weatherly, Penna., when he was fourteen years old, and he is only sixteen now. The total cost was only $7.00, and the boat easily holds two persons. Eugene wins a $3.00 Workbench award for this snapshot.



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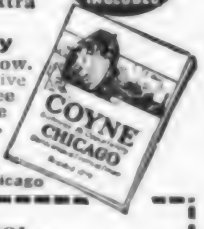

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Editor's Workbench Chips

[*Continued from page* 12]

cylinder gasoline engines of the four-cycle type. They usually are ½ or ¾ h.p., just right for a scooter or a small car. These engines are relatively inexpensive even new, and extremely cheap when bought second-hand.

***

The Fleet's In!

Never in the long history of MI has reader interest in boat construction been more intense than at present. Some days of the week we are really swamped by blueprint orders.

Roland Cueva's 18-foot auxiliary, temporarily known as the "Benjamin F. Packard," has been given the final name "Bonnie." The first installment of a series of articles describing its construction will start next month. This will be the most complete boat "how-to-build" ever presented in MI, and we predict that the boat itself will be duplicated by builders all over the country. Two other members of the MI editorial staff are working on new boats, which will be written up eventually either in MI or the next edition of HOW TO BUILD 20 BOATS. George Daniels is completing "Woggle," a 16-foot cabin sloop, and I am just starting "Sand Piper," a 14-foot plywood runabout with inboard motor. Sam Rabl, down in Baltimore, is elbow deep in drawings. All in all, it appears that the Fawcett Fleet is well under way.

***

Radio Revolution

Hailing frequency modulation as "one of the most significant" contributions to radio in recent years, and declaring that FM broadcasting on a commercial basis is desirable in the public interest, the Federal Communications Commission recently assigned the frequency band of 42,000 to

[*Continued on page* 15]

What's this? A motor launch going out to pick up the passengers in a seaplane? Might be, but it isn't! The boat is a model, "Yumping Yimminy," described in the MODEL BUILDER'S HANDBOOK, while the plane is also a model. The builder of both jobs is Leslie M. Adams, P. O. Box 251, Orlando, Fla., who wins a $3.00 Workbench prize for this interesting picture. The plane is his own design and has flown successfully both as a landplane and as a seaplane.

Editor's Workbench Chips

[*Continued from page* 14]

This midget car is completely air conditioned; even the driver sits out in the open air! It was made by Jim Staker, 6020 Central Avenue, Kansas City, Mo., who used a lot of old auto parts. Motive power is furnished by a ¾ h.p. washing machine engine, driving the rear wheels through pulleys and chains to give a high speed of 15 m.p.h. and a low speed of 7 m.p.h.

"Although I didn't build this car directly from the plans which appeared in the May, 1938 issue of MECHANIX ILLUSTRATED," writes Jim, who will receive a $3.00 Workbench award, "I did get many helpful ideas from them."

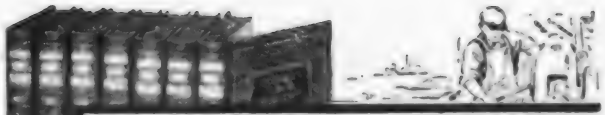
The complete plans for the "sidewalk runabout" also appear in the No. 7 edition of HOW TO BUILD IT. This is a 144-page book and costs only 50 cents a copy. If your newsdealer hasn't any copies left, write directly to Fawcett Publications, Inc., Greenwich, Conn.

50,000 kilocycles for this new and revolutionary type of broadcasting. At the same time it pushed television into the background, temporarily at least, by upholding its ban against commercial telecasting.

Whereas the television hearings before the FCC were marred by the bitterest kind of disagreement among radio engineers and executives, the FM proceedings were remarkable in that everyone admitted the benefits of Major Edwin Howard Armstrong's invention. Whereas radio set manufacturers were practically forced into television production against their own will by RCA's promotion campaigns, they needed no coaxing to get on the FM bandwagon. The whole industry is working overtime to get its brand new line of FM receivers on the market by late summer or early fall. For the benefit of radio experimenters, we are preparing a series of articles on the subject, to start probably in October or November MI.

Already ranked with Hertz and Marconi because of his fundamental contributions to the art, Armstrong is now without question the No. 1 inventor in the radio field. The long article about FM that appeared in the May, 1940, issue of MI ("Goodby to Radio Static and Interference") was criticized as a bit too optimistic in its promises, but the FCC approval now removes all doubts.

[*Continued on page* 16]



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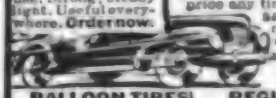

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29x4.75-20	2.50	1.35
29x5.00-19	2.65	1.35
30x5.00-20	2.65	1.35
6.25-17	2.90	1.35
29x5.25-19	2.90	1.35
29x5.25-20	2.95	1.35
30x5.25-20	2.95	1.35
31x5.25-21	3.25	1.35
6.00-18	3.27	1.45
29x5.50-19	3.35	1.45
29x5.50-20	3.35	1.45
6.00-17	3.40	1.45
30x5.50-19	3.40	1.45
31x5.50-20	3.40	1.45
32x5.50-20	3.45	1.55
32x6.00-21	3.65	1.55
32x6.50-20	3.75	1.75
6.00-16	3.75	1.45

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29x4	2.95	1.25	30x5	3.65	1.65
30x4	2.95	1.25	30x5	3.75	1.75
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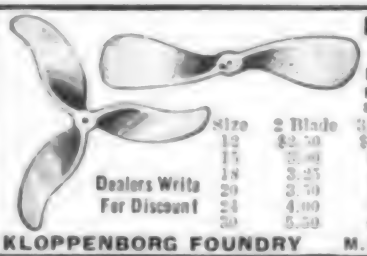

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Editor's Workbench Chips

[*Continued from page* 15]

"As close to flying as you can get without an airplane" is how William Terpstra, of Sonyea, N. Y., describes the action of "Tiny," a midget class racer he built from plans in the 1938 edition of HOW TO BUILD 20 BOATS. This picture shows his son Billy handling the boat all alone! For this fine action snapshot, the builder will receive a Workbench award of $3.00.

A Good Book

One of the most complete literary contributions to the welder is the "Procedure Handbook Of Arc Welding Design And Practice." Compiled by the Lincoln Electric Co., of Cleveland, Ohio, the book covers practically every phase of the subject. It is not only an instructive treatise for the welder himself, but also for the engineer and the designer. Each branch of welding discussed is clearly illustrated by both drawings and photographs. The technique of welding is thoroughly explained in similar fashion. An aspect hitherto less adequately treated is also handled in complete detail. That aspect is "weldable" engineering design. This type of design takes advantage of arc welding with considerable resultant economy in the construction of nearly all types of mechanical and architectural projects, and reveals the practicability of the weld on most common metals.

[*Continued on page* 17]

This glider was built by Burell Stevens, of Universal, Ind., from plans that appeared in the old MODERN MECHANICS in 1931. So far it has cost about $25.00. It hasn't been test flown yet, but Burell expects to get it up the first time the weather is favorable. The $3.00 Workbench check that he will receive will help to buy some of the hardware he still needs for the job.

By the way, those of you who are interested in aviation certainly won't want to miss the new FLYING MANUAL, a 144-page book of up-to-date "dope" on modern aeronautics. Your local newsstand has copies at 50 cents each.

Editor's Workbench Chips

[*Continued from page 16*]

This sporty, low-slung motorcycle was designed and built by Addison Marshall, of Hebo, Oregon. It uses 16-inch wheels and is powered by an old Evinrude outboard motor which gives it a speed of about 12 m.p.h. The engine is water cooled, a section of an automobile radiator being mounted just behind the front fork. The drive to the rear wheel is by V belts. The framework is ¾-inch conduit. This is an unusually natty little job and wins a $3.00 Workbench prize for its builder.

Again Regarding Pictures

"Workbench" contributions have increased to the point where it is virtually impossible for me to acknowledge them individually. If I can't use particular items because the pictures are unsuitable for reproduction, I'll return them immediately. However, if the snapshots are good and the projects interesting, I'll keep them for future use. Therefore, if you don't hear from me within a short time after mailing in your contribution, you can be pretty sure it will be published in the "Workbench" sooner or later.

Write or print your name and address clearly on both your letter and on the backs of the pictures.

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Robert Hertzberg, Editor

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Popular Patents

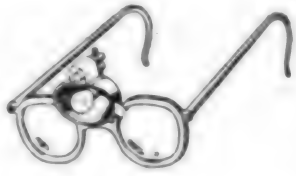
Convertible chess and checker pieces which may be used on a common checker board and which may be readily changed from one form into the other won a patent recently. To accomplish this result the inventor provided flat checker discs with slots into which usually shaped upper chess pieces may be fitted. When it is desired to play a game of chess, each of the various chess portions are locked into the checker disks. After the game of chess is finished and a game of checkers is desired, the upper chess portions are easily removed.

* * *

To keep cattle from straying, Joseph Glidden developed barbed wire. Subsequent use of the wire netted him a fortune.

* *

Something new in spectacles is provided by a recently patented combination of a pair of spectacles, an electric light and a switch which is controlled by a mere nod of the head. The lamp is mounted on the nose piece between the lenses. A mercury or gravity type switch automatically lights the lamp, the current being supplied by a suitable battery.



* * *

The bow and arrow has been considered by some to be man's greatest invention.

* * *

Windshield wipers for side windows of automobiles ensure clear vision in rainy or snowy weather when side ventilating windows must be kept open. By means of a single lever manipulated by the hand of the driver, wipers on the inside and outside of a side window readily clean rain from the outside and fog from the inside. The wipers are mounted on a clamp which fastens to the bottom of the window.

[*Continued on page* 19]

Popular Patents

[*Continued from page* 18]

Industry in the United States is founded largely upon patent rights.

* * *

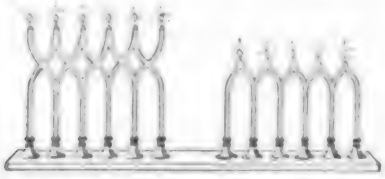
To toss long straight football spirals, you no longer need be a star of the gridiron. By playing with a newly patented football provided with curved fin-like surface ridges, not only is spiralling easy, but in addition the ridges help the player to hold the ball after receiving a pass.

* * *

Approximately 2,200,000 patents have been granted by the Patent Office.

* * *

A new high in decorative candles has been reached by an inventor with a flair for ornamental novelty. The candle is made up of a number of trunk portions with branches which fork out from the trunks. These branch portions are shaped to intersect at a higher point, to obtain a criss-cross design. As the candle tips burn down, points of crossing are reached and the number of flames are reduced by one-half. As soon as the crossing points are passed, the flames double in number. By the use of suitable chemicals in the candle wicks, red, yellow, and blue colored flames may be obtained, a new color appearing as each new set of crossings is reached.

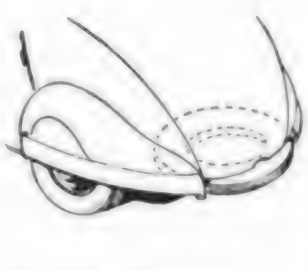


* * *

Did you know that certain varieties of plants may now be protected by patents.

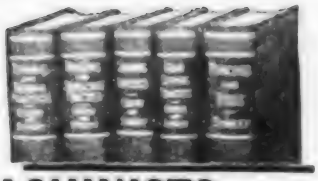
* * *

Don't spare your tire and you can protect your car, simply by using your spare tire as a bumper. This new use for a tire is described in a recent patent. By suitably mounting the tire either at the front of the car or at the back, or in both places, complete protection is obtained against bumps. In an emergency, the tire may be removed to replace a flat tire.



[*Continued on page* 20]

Increased production means more



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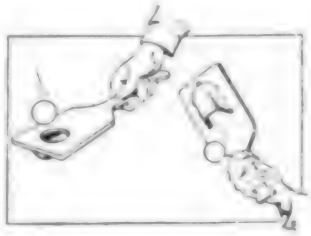
Popular Patents

[*Continued from page* 19]

If two inventors file patent applications for the same invention, an interference contest is set up to determine who is the first inventor.

* * *

A new game for ball bouncers was disclosed when a patent was granted for a paddle having an opening and a ball pocket. The paddle is used to bounce the ball against a wall after which the player tries to get the ball to pass through the hole in the paddle on the rebound. As the ball passes through the hole, it is caught in the pocket connected to the bat in back of the opening. The ball is then permitted to fall out of the pocket to be played again.



* * *

Patent pending marked on an article merely means that a patent application has been filed. When the patent is granted, the article, or in some cases the package in which the article is sold, must be marked PATENTED with the number of the patent, in order to protect the inventor.

* * *

Motor police have a new patented attachment available for catching fleeing automobiles. While police have been obliged in the past to block a speeding car by the dangerous method of driving alongside and in front of the car, they may now drive behind the car and take it into custody by means of a cable attachment fastened to the police car by a modified fishing reel. The cable is connected to a hook which grabs the rear bumper of the escaping vehicle when the police car overtakes it from the rear. Flexible controllable connections on the police car enable that car to be controlled in making sudden turns or stops caused by the car in front. The cable may be drawn in or let out by the police car. For policemen who are fishing enthusiasts, this device should provide sport while they work.

* * *

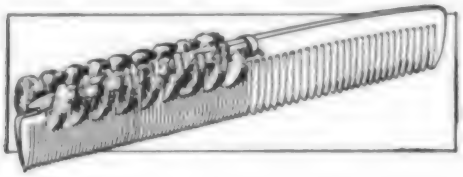
To combat submarines during the first World War, over 100,000 inventions were considered by a naval board.

[*Continued on page* 21]

Popular Patents

[*Continued from page 20*]

A combination comb and brush recently patented accomplishes a double function of combing and brushing hair at the same time. The brush is detachably mounted to enable its separation from the comb. The bristle portion is in the shape of a spiral fastened to a wire shank. The ends of the shank are attached to a hole in the comb when the combination is used.



* * *

Approximately 700 examiners are employed by the Patent Office to pass on patent applications.

* * *

A bicycle guard with side arms affords protection from collision according to a recent patent. The guard is fastened at the top to a mud guard and at the sides to the hub of the wheel. A cross bumper mounted at the front of the guard provides protection against damage.

* * *

Other recent patents include a perfumed rubber sponge to overcome the odor of the rubber . . . A dog leash that glows in the dark . . . A lamp socket that prevents removal of the bulb . . . and a theft proof auto license plate.

—*By Morton Leese*

Patents Identified

Chess Set	2,196,861	Tire Bumper	2,196,225
Spectacles	2,196,543	Ball Paddle	2,194,761
Wiper	2,196,542	Car Catcher	2,194,623
Football	2,194,674	Comb-Brush	2,194,484
Candle	2,196,509	Bicycle	2,194,660

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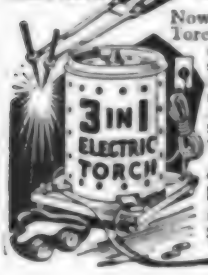

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Oversize Typewriter Weighs 14 Tons

Operating this giant typewriter with her feet, this young lady demonstrates the application of stenographic technique to a machine 1,728 times larger than the standard size. A World's Fair exhibit, this typewriter resembles the smaller machines in detail. The typing arm can be seen rising toward the paper as the operator depresses the key with her right foot. An idea of the size of the machine can be gained by noting the comparative proportions of the shoes of the operator and the typing keys.

***

"It started out to be a doghouse."

Talking Fish Gives Radio Speech

Addressing the nation in a recent broadcast, this South American Talking Catfish employed a special microphone to assure his listeners of accurate reception of the vital topics discussed. Although apparently enthusiastic over his opportunity to deliver the fish viewpoint over the air, the finny speaker evidently spoke an unknown tongue. On the whole, his part of the program consisted of a series of gurgles and grunts, each syllable of which, however, held the eager attention of the audience. This is believed to be the only talking fish to broadcast to date.

Rubber that conducts electricity has been produced in England.

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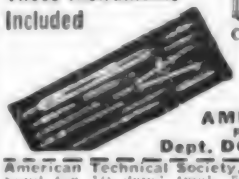

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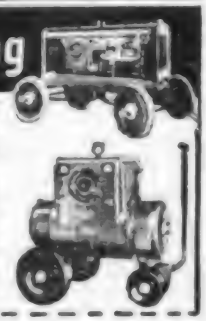

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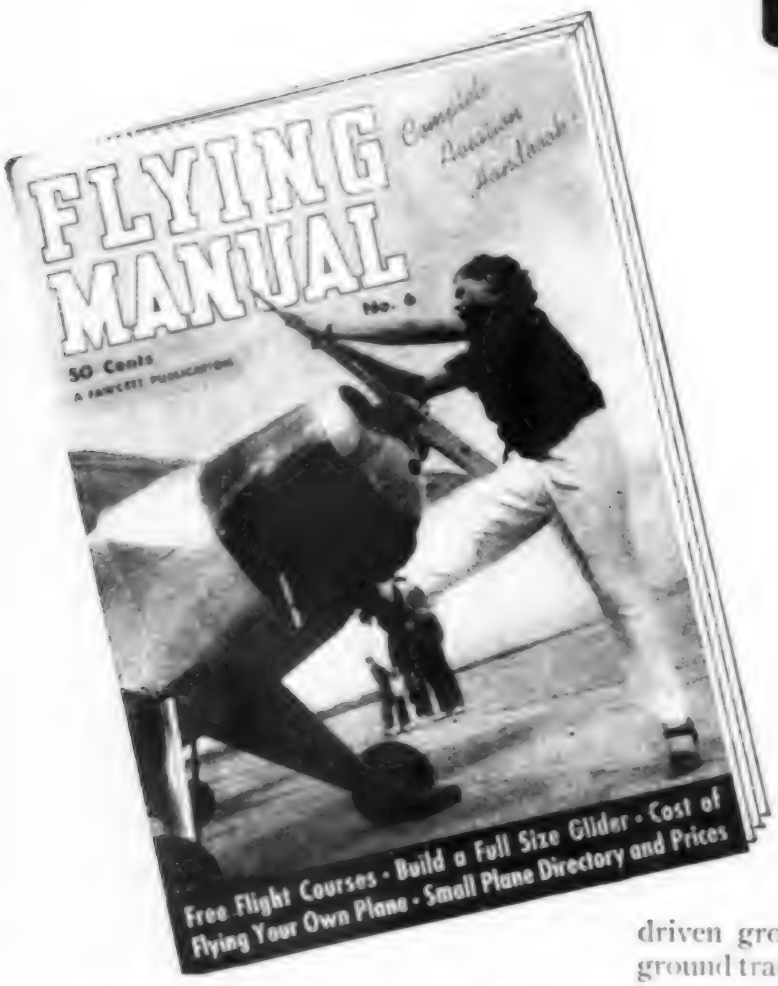

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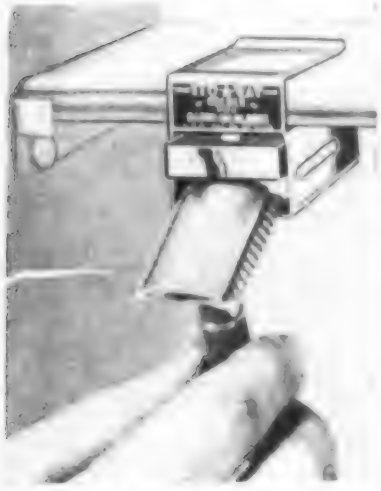

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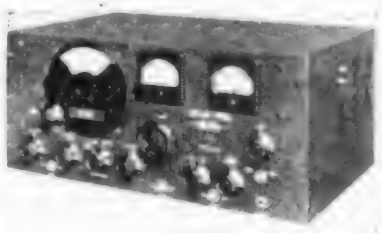

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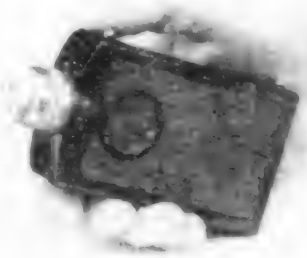

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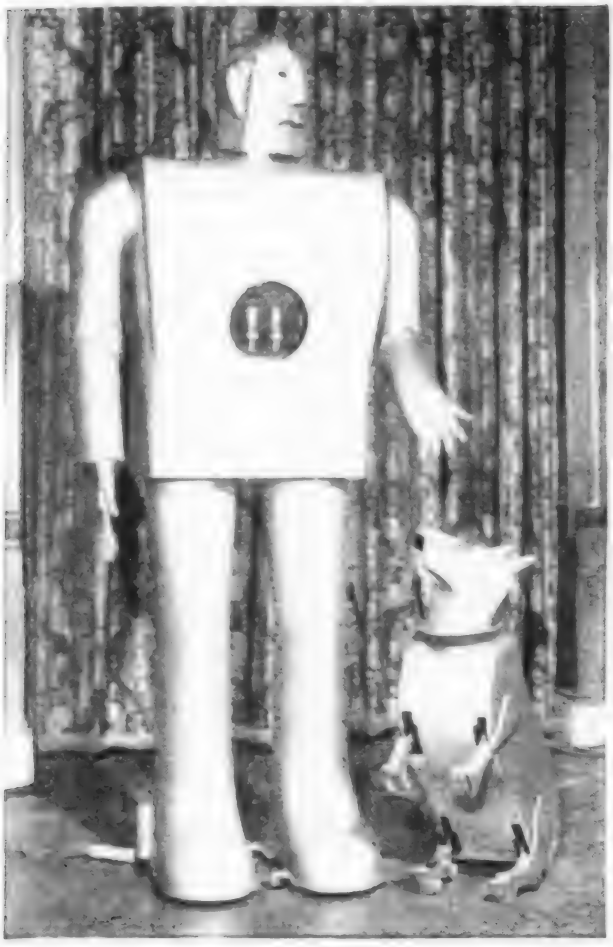

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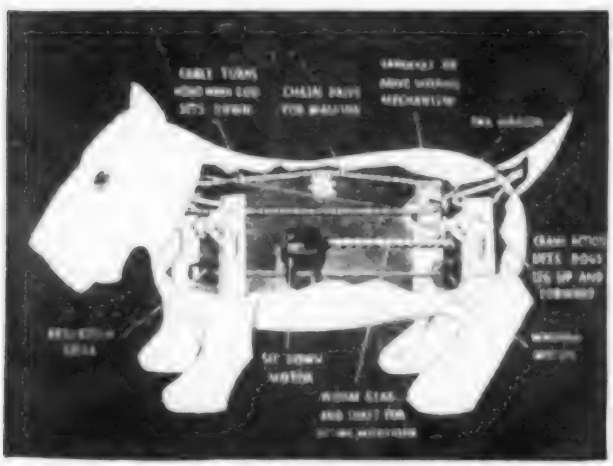

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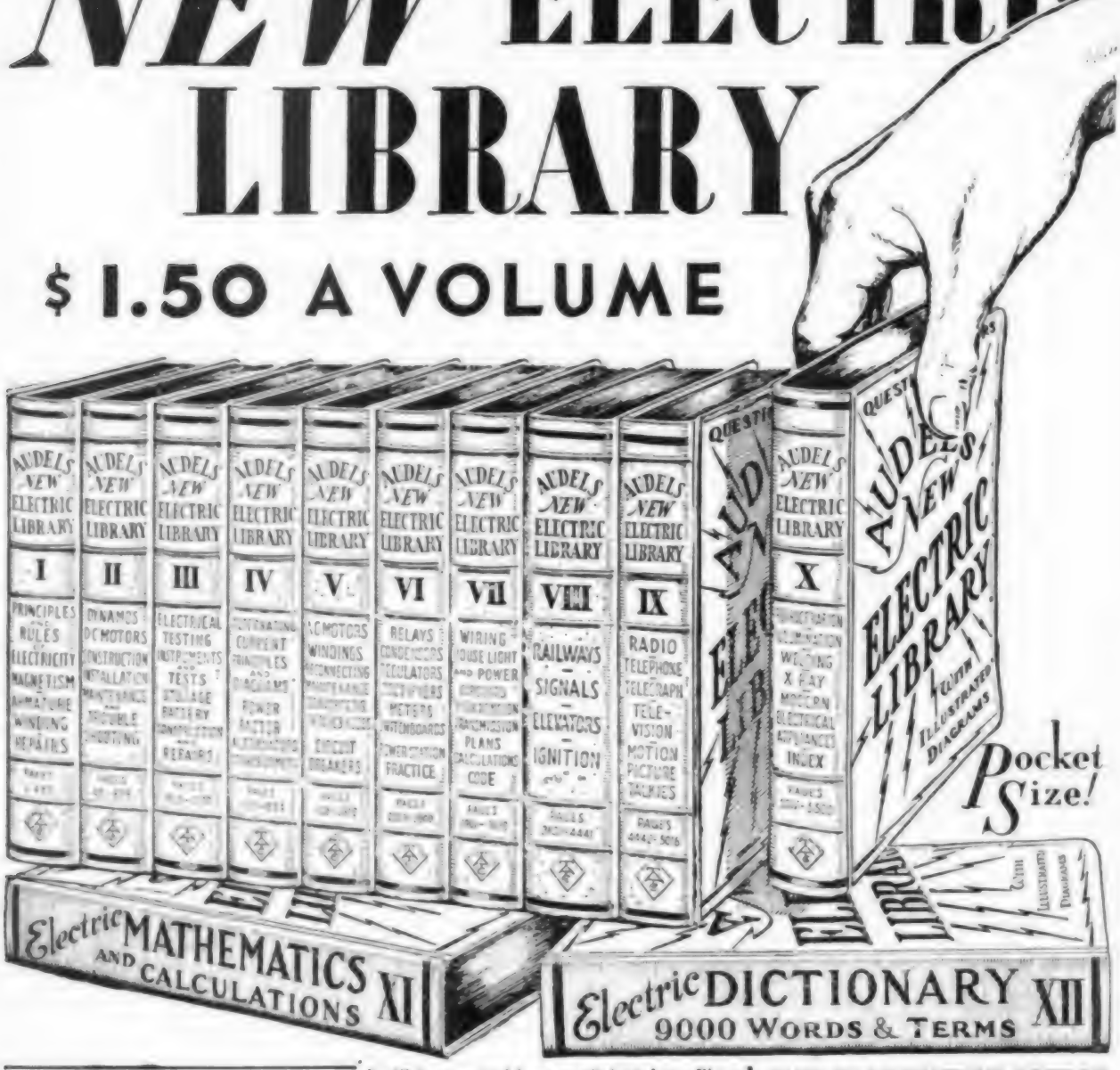

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Vol. XXIV
No. 4

AUGUST
1940

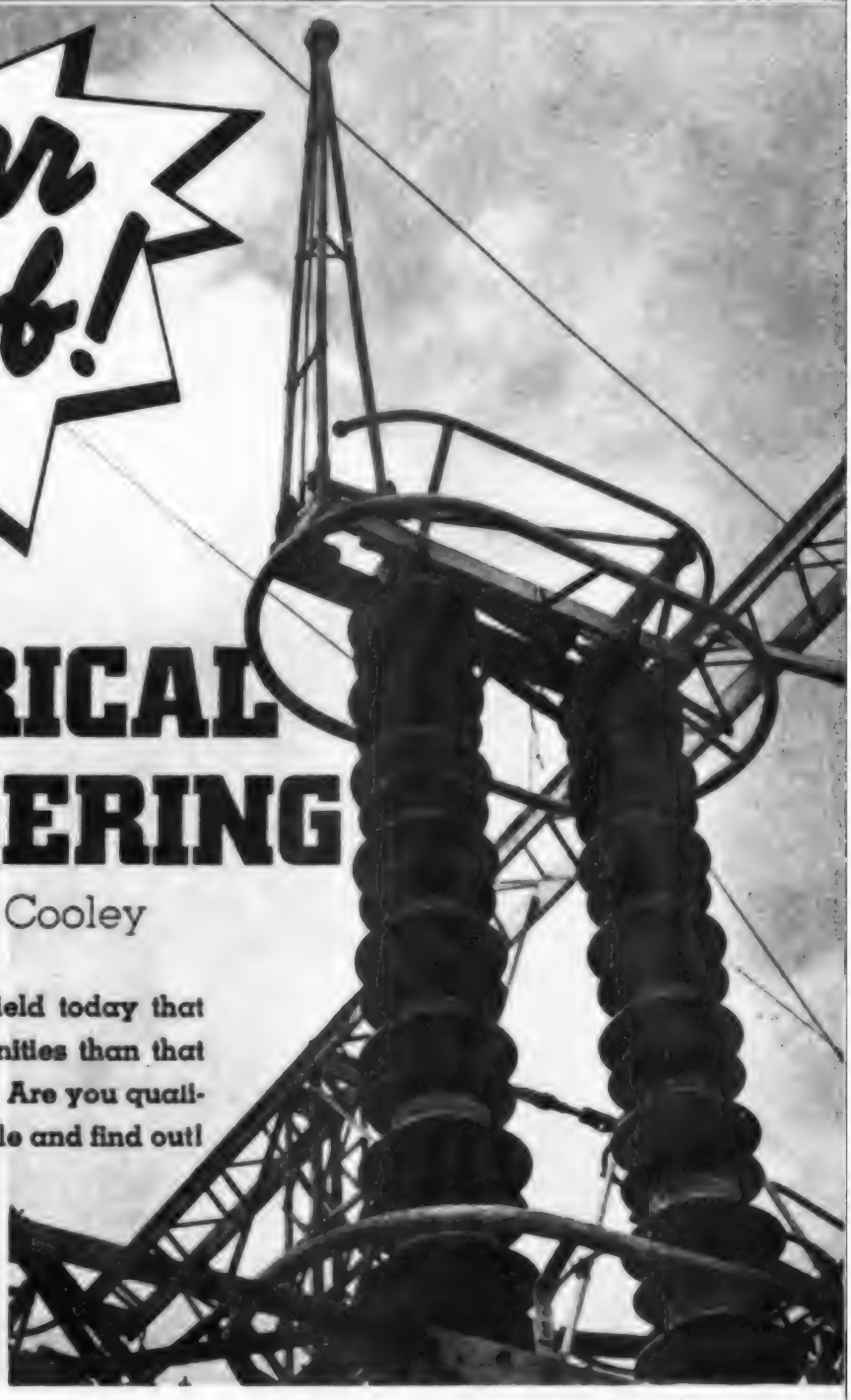
MECHANIX ILLUSTRATED

your job!

ELECTRICAL ENGINEERING

by Donald G. Cooley

There is no vocational field today that offers more new opportunities than that of electrical engineering. Are you qualified for it? Read this article and find out!



Right: Modern power equipment is exemplified in this disconnecting switch in the great 287,500 volt switchyard at Boulder Dam, on the Colorado River.

"MR. MORGAN," said the professor of mathematics at the University of Goettingen, "I beg you to think seriously of mathematics as your life work. With your genius, you can be sure of an immediate position as an instructor and you will have every reason to expect to succeed to my post as head of the mathematics department after my retirement."

The young university student, however, decided to apply his talents in other fields. He went into finance and founded the firm of J. P. Morgan & Co., the most influential firm of private bankers in the world.

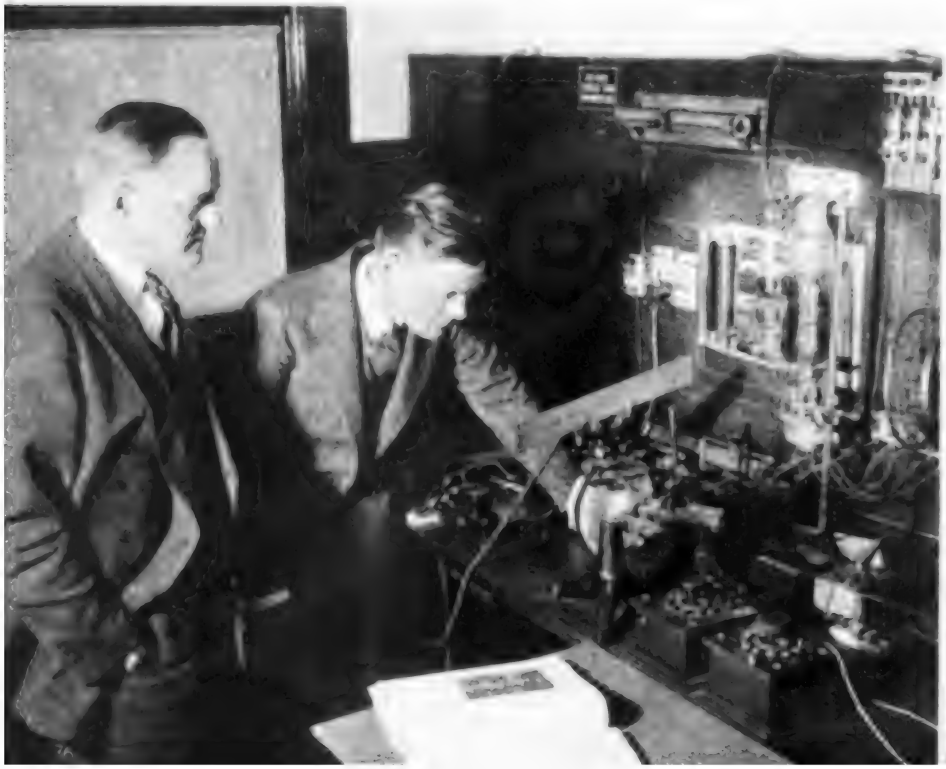
The many different branches of electrical engineering defy a complete listing. When a huge project such as a new New York City subway is undertaken, hundreds of men must draft the complex electrical system to run it.

If you are thinking that J. P. Morgan's career has nothing to do with you or with electrical engineering, let's see just how it does apply to both.

Morgan had a number of definite talents—just as you have. These aptitudes—executive capacity, creative imagination, unusual mathematical ability—would have enabled him to become an outstanding electrical engineer had he so desired. He was fascinated by the young field of electricity. His home, still standing on Madison Avenue in the heart of mid-town New York, was the first private residence in the world to be equipped with electric lights.

Your own talents can be put to work in many different ways. If your aptitudes fit you for the work of an electrical engineer you could be almost any other kind of engineer as well, for all engineering subjects are closely related. You could also be a business executive, for the engineering graduate is thirty times more likely to become a corporation officer than the graduate of a standard college.

What, particularly, does an electrical engineer do? You begin to see that the question isn't easy to answer when you learn that 65,000 different uses of electricity have been catalogued, and the list is still growing. It is only a little over 50 years ago since Edison built his first central electric power plant — the birthday



These electrical scientists are doing valuable research work at the Bell Telephone Laboratories, in New York

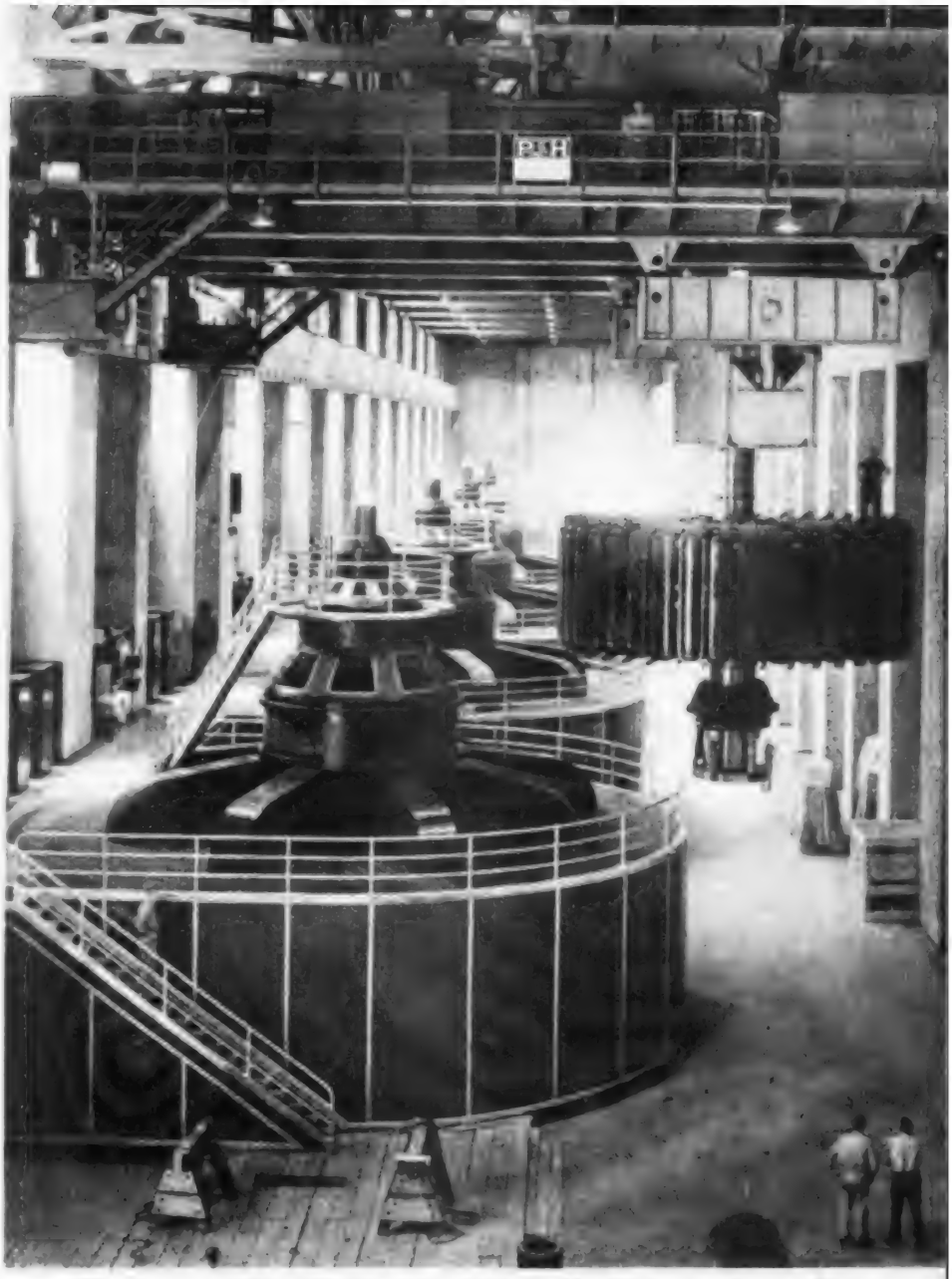
practically speaking, of electricity as we know it.

Dr. Karl Compton, president of the Massachusetts Institute of Technology, has told a story which reveals strikingly how young a business electrical engineering really is.

In 1889 two graduates of Massachusetts Tech planned to set up in business as consulting engineers. Charles A. Stone and Edwin S Webster talked over their project with their professor. He advised strongly that only one of them go into the business.

"There may be enough consulting work in the country to keep one electrical engineer busy, but not two!" he warned them.

The two young men went ahead, however, and the firm of Stone & Webster is still actively engaged in electrical engineering counsel — with scores of other corporations doing the same kind of work.



The generator gallery, Nevada wing, of the Boulder Dam power house. Four of the world's largest generators are operating here, and the 600-ton rotor of the fifth is being carried down the gallery by two huge cranes. Each of these generators has an 82,500 kilovolt-ampere capacity.

The variety of jobs open to the electrical engineer is unbelievable. He designs, manufactures, calculates performance, sells, installs, and services a staggering variety of equipment for all industry.

All of radio, all of telephony, all of television is basically electrical. Sound movies could not exist without the electron tube. Railways are made safe by electricity and trains are pulled by it, alone or with Diesel drive. Industry is run by electric power, homes are made comfortable by it—but with 65,000 specific uses already charted, we can't even attempt a complete listing.

One man turning a crank would be hard put to it to generate enough electricity to light an ordinary house lamp. In practical terms, electricity is energy—billions of man-power of it. And that fact makes it a peculiar engineering problem.

You can't hold electricity in your hand. You can't measure it with a rule. You can't even put a description of it on paper, in any ordinary sense. But you can describe it and calculate what it will do and lay plans for harnessing it by mathematical reasoning. So mathematics is absolutely indispensable to the electrical engineer.

For that reason, unless you answer "yes" to the first question in the MECHANIX ILLUSTRATED aptitude test on page 39, you will avoid heartbreak and the loss of time and money by dropping electrical engineering like a live

A General Electric television engineer adjusts the tubes in a television control. This field offers great opportunities to the electrical engineers of today and tomorrow

Above: It looks like a cross between a tractor and a crane but what it is really is a dolly-mounted television camera. Left: Electrical experts get turned into odd fields—here is Dr. William Braid White, accoustical expert, testing the sound absorbing qualities of the upholstery in an automobile

wire. Of course there are other branches of electrical work, which we will presently consider, where mathematical ability is not quite so necessary.

If all this seems obvious to you, it may surprise you to learn that scores of young men flunk out of engineering courses every year with the sad remark, "I didn't know you had to be good at math to be an engineer!"

Do you like physics? Do theories about the fundamental basis of matter, involving

BALANCE SHEET

For Assaying the Electrical Engineer's vocation

ASSETS	LIABILITIES
Field is constantly expanding; possibilities "have barely been scratched"	Qualifications are very high; aptitude for mathematics essential in highest engineering posts
Industrial and social standing of engineer is extremely high	Competition is with specialists of highest intelligence
Close to the heart of *all* industry	Time and money must be invested in books and training for maximum income possibilities
Contacts are with the most important men of the business world	Broad cultural and human background almost as essential as technical training for highest advancement
Earning power increases rather than diminishes with age	Takes plenty of energy, enthusiasm and ambition to reach the top
Engineers are 10 times more likely than non-engineering graduates to hold executive positions	
Opportunities so varied that almost any temperament can find congenial job	
Definite training makes problem of finding a job relatively easy	
Some branches offer opportunity of going into business for one's self	
Financial rewards good to excellent	

Test Your Qualifications for the Vocation of
ELECTRICAL ENGINEER

Answer every question to the best of your ability either "Yes" or "No," indicating your answer with a check mark in the space provided. Do not rush, but take all the time you need to answer thoughtfully.

	YES	NO
Are you a "math shark," with a liking for all forms of mathematics?		
Does pure science—the realm of research, theory, and speculation—fascinate you? At the same time, do you have a practical turn of mind that likes to see analytical theories put to work in useful mechanisms?		
Do you most enjoy and get your best marks in physics, chemistry, drafting, shopwork, as well as mathematics?		
Are you keenly interested in such recreations as chess, bridge, checkers, and mathematical puzzles?		
Are you painstakingly careful, cautious, and scrupulously accurate in every job you do?		
Do you take detail work in your stride and is your memory a retentive storehouse of innumerable facts? Have you ever experimented with radio or followed a comparable hobby that is predominantly electrical?		
Would you say that your creative imagination is above average—you are inventive, ingenious, visualize familiar things in new combinations?		
Is your interest in electricity such that you already "speak the language," understanding the meaning of watt, ammeter, alternating current, generator, transformer, ohm, armature, commutator, arc, photo-electric cell?		
Do you like to work with objects?		
Have you demonstrated mental alertness by ranking with the top third of your class, making good in a job or activity requiring headwork?		
Is it as easy for you to learn from books and texts as from practical experience?		
Can you read blueprints and diagrams, and understand drafting principles?		
Is your health good enough to endow you with energy and enthusiasm so that you welcome hard work and plenty of it?		
Can you tackle electrical engineering with self-confidence when you understand the demands and disappointments as well as the rewards of the career?		
As a matter of habit, do you plan things carefully before going ahead?		
Do you regularly read popular scientific magazines and at least occasionally dip into heavier electrical and engineering books?		
Do people usually respect your opinions and act as if you know what you are talking about?		
Are you perfectly at home around electrical machinery and apparatus?		
Do you express yourself well in speech and writing, with a good-sized vocabulary at your command?		
Is your background broad and varied, reflecting keen interest in the countless aspects of living in an "engineering" civilization?		
Are you active in extra-curricular school activities, lodges, clubs, committees, requiring management and organization?		
Do you get along well with people, developing your human side?		
Can you invest time and money in books, colleges, trade school or technical courses required for electrical engineering training?		

Every "Yes" answer counts 4: "No" answers do not count. For reasonable electrical engineering aptitude, you must answer "Yes" to the mathematical questions, with a total score of not less than 80. A score between 60 and 80 may still indicate satisfactory aptitude for specialized electrical training, such as technicians; mechanical ability and skill in working with one's hands counts more heavily there than in straight engineering.

neutrons and electrons and positrons, fascinate you? Fine—that is an excellent sign because electrical engineering is closer to pure science than any other profession except research. Researchers worked out countless facts about electrons in the laboratory, but it took electrical engineers to make television sets and sound movies out of those facts.

[*Continued on page* 132]

Showing a temporary television set up, for the first successful two way television demonstration

Mechanical Cop Gets Its Man

THE invention of B. F. Palmer, Tulsa, Oklahoma, engineer, this "mechanical policeman" consists of a speedometer that keeps a record of the speed and distance a car travels. A driver can check up on his speeds after a trip, and so can an officer!

Pomato Or Topato?

LATEST wonder of the plant world is t cross between a tomato and a potato, pr duced by George H. Chisolm, superintend and horticulturist at the Yonkers, N. Y., esta of the late Samuel Untermyer. The "pomat (or "topato," if you like that better) is s to be non-fattening.

Model Hen Shows How It's Done!

TO EDUCATE the farmer, and the public in general, the U. S. Department of Agriculture has opened a new exhibit in Washington, D. C., which depicts various aspects of agriculture. The picture on the left shows one of the exhibits, an "egg factory" inside of a large size hen, which gives a graphic example of how an egg is produced.

Mechanix Illustrated

He Has All The Comforts Of Home!

RALPH DeVOE, 18-year old member of the D. A. R. Boys Club of Menominee, Michigan, is shown in his trailer presenting his credentials to the doorman of a Boston hotel after a 1,200 mile trip from his home in Michigan. He slept many nights in his homemade trailer, which weighs 196 pounds, and enthusiastically claims that it's the last word in rolling homes, even if it is a bit cramped.

Rear-View Mirror Eliminates All Glare

RECENTLY introduced, this new rear-view mirror totally eliminates glare in night driving, without changing the field of vision. This ingenious device utilizes an optical principle in which two reflecting surfaces are provided by means of a wedge-shaped glass, the two surfaces of which are at a slight angle with each other. For daytime driving, the rear-view image passes through the front surface of the wedge and is reflected normally.

U-Boat Defense Seen In New Mine

LESLIE CROSBY, of Springfield, Mass., works on the robot motor-mine which he has devised and which he hopes will revolutionize U-boat defense and attack methods. The mine is activated by sound vibrations from a ship's propellers and turbines while the mine rests anchored in the water. These vibrations start the mine's propellers, and it starts for the objective, steered by the rudder that is controlled by the frequency ears.

MONARCH

The only means of communication between San Miguel and the outside world is the distress signal made by hoisting a tattered upside-down United States flag.

WHEN Herbert S. Lester leased lonely San Miguel island, off the California coast, from the United States Navy and took his wife and two daughters with him to establish a home on it, his friends, to put it mildly, thought he was crazy. Today, with the "civilized" world in the state it's in, more than a few persons are willing to concede that maybe it wasn't such a bad idea.

The Lester family live in a spacious ranch home built of tongue-and-groove lumber salvaged from the four-masted schooner, *J. F. West*, which was wrecked on the island's shores during a heavy storm. The Lesters, quite contented with what many would consider a lonely existence, share the island with a flock of 1200 sheep which they tend.

With no communications available, Lester hoists a tattered American flag upside down as a distress signal when he needs help. Twice each month, George F. Hammond, a friend of Lester's, flies forty miles from the mainland, at Santa Barbara, in his private land plane to bring mail and supplies.

The two Lester children, Marianne Miguel and Elizabeth Edith, attend school in a tiny room built in their front yard, overlooking the Pacific, with their father for a teacher. As a hobby, the entire family builds furniture in their home workshop.

Although they consider

Lester and his family compose a small home workshop organization. Here Elizabeth Edith, 6 years old, demonstrates her proficiency with workshop tools.

OF ALL HE SURVEYS!

Left: An air view of the Lester's isolated home on the slope of San Miguel island. Above: Lester is prepared to rescue crews of ships which may be wrecked on San Miguel's treacherous shores. Here he demonstrates the use of a life-line gun to Marianne Miguel, 8, and Elizabeth Edith, 6.

themselves pioneers, both Mr. and Mrs. Lester's names once appeared in the Social Register of New York City. Mrs. Lester is a descendant of Roger Sherman, a signer of the Declaration of Independence and governor of Connecticut.

Their island home is swept by almost continual gales, and to meet the emergency of shipwrecks, Lester keeps on hand a life-saving cannon.

Lester pretends he is the monarch of an independent kingdom, and wears cloth epaulets on his sweat shirt.

George Fisk Hammond, sportsman pilot, flies the mail to San Miguel in his plane. With him are his wife, Mrs. Lester and her two daughters.

Baseball for the BLIND!

Above: A blind pitcher winds up for a fast one. Right: "Strike one!" A blind batter swings wide.

ONE of the most popular sports is now made available to the blind. A remarkably ingenious system of cables permits the sightless players to play the game with practically the same basic rules as are generally followed.

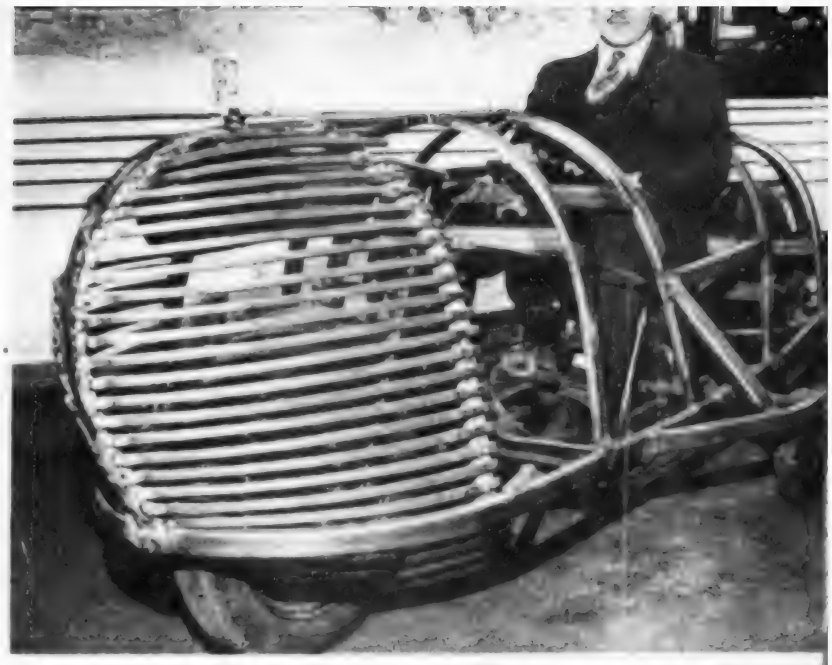
The ball is replaced by a ring which is "pitched" along a cable with a stick by the man on the mound. The catcher stops the ring with a sliding block on the cable, and then returns it to the pitcher with a shove. The hitting ability or "batting average" of a blind player is largely determined by the accuracy with which he can gauge the position of the sliding ring by its sound. The pitcher must, of course, use the same method to stop the ring.

In running the bases, the players follow a cable. A sliding leather strap guides them along the base line. One, two, or three bases may be used. When there are more than one, the runner must change straps. A great aid to health and morale, this game may soon be adapted by many blind institutions throughout the country.

Right: When the fans yell "Slide!" they really mean it. A blind base runner runs the "slider."

The Latest Thing In Air-Cooled Cars!

THIS odd-looking contraption, dubbed an "autocycle," was recently built by T. James Stinson, of Cleveland, Ohio. Powered with a motorcycle engine, it has four wheels, can travel 45 miles an hour, and uses a retractable "landing gear." The welded steel frame is mounted on two motorcycle wheels with room only for the driver. The puzzle is whether the machine should take motorcycle or automobile license plates.

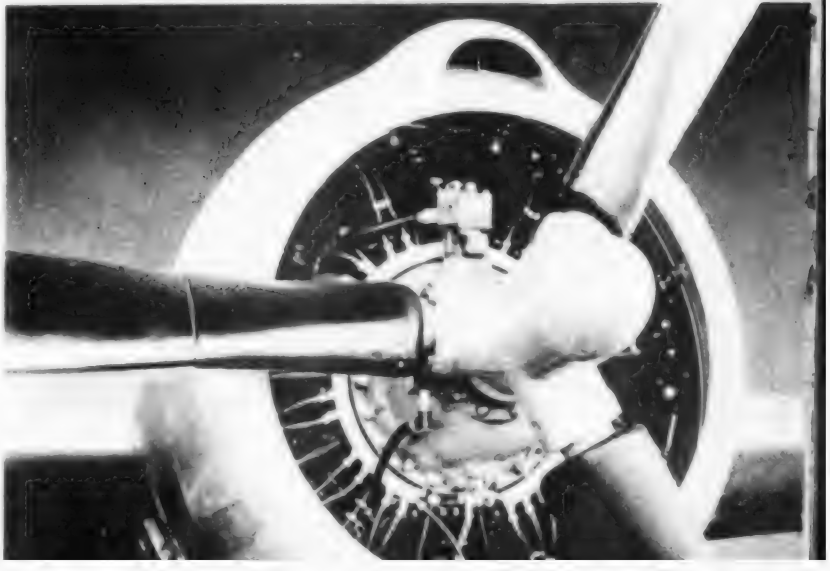


Vacuum Bonnet Cleans The Face

NOT a new type of gas mask is this head covering, but a new type of beauty bonnet, designed to give treatments in a vacuum. Made of stout, light wire and covered with a strong oiled silk, the "bonnet" has a front window through which the wearer may see. Air is pumped out with a mild electric pump, or else a pump that may be operated off any water faucet. The operation of a vacuum on the skin is said to be very beneficial for cleaning out the pores, and refreshing the skin.

Blade Cuff Increases Propeller Efficiency

ILLUSTRATING the latest advance in the design of propellers for high speed military aircraft is this propeller equipped with the new blade shank cuffs now in production for installation on many types of U. S. Army and Navy planes. Tests have shown that through the use of cuffs, cylinder temperatures of air-cooled planes can be lowered, take-off thrust increased and blade shank drag of high speed installations reduced.



Two Heads

Following in the footsteps of another pair of Ohio brothers, the Wrights, the Funk twins are a striking contradiction to the old saying: "He travels fastest who travels alone." They're going places fast—and doing it together!

by
Walter E. Burton

Above: The Funk twins in a characteristic pose, threshing out an idea for their plane at the drawing board. Howard, the expert of plane design, is standing while Joe, the engine specialist, wields the pencil and triangle.

Right: The original Funk glider in the air. This craft, incorporating new ideas in aerodynamic design and performance, was the granddaddy of their present light plane.

THERE is little in common between chicken wings and airplane wings. Both, however, played vital parts in the success of the Funk Twins. For it was largely chickens that enabled them to get started on a double-barrelled career that has developed into one of the fastest-growing airplane manufacturing enterprises in the country.

The Funk brothers are identical twins. The way you tell Howard from Joe is that Howard wears glasses. Otherwise they look exactly alike. But they don't work that way. Joe is a specialist on engines, while Howard is an expert on airfoils and other elements of plane design. Thus they are putting to practical use the theory that two heads are better than one.

The story of the Funk Twins and the non-spinning airplane they have given American aviation began when they were boys. Their father, who operated a poultry market, died when they still were in the grades. Their mother decided to keep on with the business. The boys helped her. With the money they earned in the market, they paid their way through school. They paid for engineering courses at the University of Akron. And they bought lathes, drill presses and saws.

Like most other American boys, the Funk Twins early became interested in airplanes. They built models. Then, along about 1925, they had the thrill of taking their first ride in an actual plane, a ride that was a milestone in their twin careers.

Appetites whetted by this taste of aviation, the Funk boys worked out a fairly definite idea of what they wanted to do with their lives. They decided that aviation was their field. And they set about with characteristic method to work down that field to some sort of goal. As the first step, they learned to fly.

ARE Better Than One!

J. H. Bunting, another twin, demonstrates how the starter of the Funk plane operates. Bunting resigned a good job to take a gamble on the success of the Funk plane and raised the capital for the new company.

Behind the poultry store was a lot of unused floor space. An ideal place for a shop. So Joe and Howard began buying lathes, drill presses and other machinery, and setting it up. With this equipment they began work on a glider. It was more than a conventional glider; it was designed for maximum safety. For one thing, it wouldn't spin. To help the glider enterprise, the boys formed a glider club. In this way they added extra hands to their own two pair

That glider lived up to expectations. In fact, its performance was so outstanding that more than one flying expert urged the boys to take the next step and incorporate its best design features in an airplane

And so the profits from the Funk market went into a motorized monoplane that slowly took form in the shop behind the store. The plane was powered by a wheezy, three-cylinder engine. That was about the only light-plane power plant available at that time. The way the engine behaved is illustrated by an experience the boys had in Michigan. One day, while they were flying over Detroit, the engine swallowed a valve. There was no place to make a forced landing in Detroit, so the boys glided across the river and set their ship down on Canadian soil. Then they had a lot of explaining to do to the custom officials. Eventually, they picked up some

Right: Note the high visibility given by streamlined engine and the generous use of windows.

An interior view of the Funk plane. It has side-by-side seating, and a new type T-head duel control.

spare parts in Detroit, patched up the engine, and flew the ship back to the U. S. A.

And that evening, in an automobile behind the hangar, they held a council of war that resulted, eventually, in one of the most remarkable aircraft engines ever produced. Joe Funk, whose meat is power plants, had had an idea in the back of his head for some time. An idea that what the country needed was a good airplane engine of 65 or 70 horsepower. And after the Canadian experience, he decided to do something about it. Howard seconded the motion.

The general idea behind the Funk engine that eventually replaced the three-cylindered wheezer is this: Most aircraft power plants are costly because the parts of which they are made are of special shape and size. If an engine could be built of the same sized valves, camshafts, bolts and other parts that automobiles use, it could be produced much more cheaply, because auto-parts machinery is available in quantity.

The Funk engine that evolved from the behind-the-hangar conference uses three parts that are of standard automotive design and materials, and a lot of other parts that are of standard automotive shape and size, but are made to aircraft specifications. It is an inverted engine. A Ford Model B block, and Ford Model B crankshaft and camshafts are the only automotive parts in it. The pistons, valves and all other elements are aircraft parts made on automotive production machinery. The engine is Prestone-cooled, and delivers 70 H. P. at 2400 R.P.M., sea level.

With the new engine and the plane, the Funk Twins were able to demonstrate many of the ideas they had nursed for years. Their ship inherited from the glider the inability to spin. It and its descendants are practically stall and spin-proof. They can be spun, but only with power on. When the motor is dead, a Funk ship cannot be thrown into a spin no matter what the pilot does wrong. And it has been said that about 90 percent of flying accidents are caused by tail spins.

The Funk boys took their experimental job to Elmira, N. Y., to attend a glider meet. There someone told them the government was offering a prize for the best design for a private airplane that could be produced in mass quantities for about $750.

Here was a chance. The twins got into

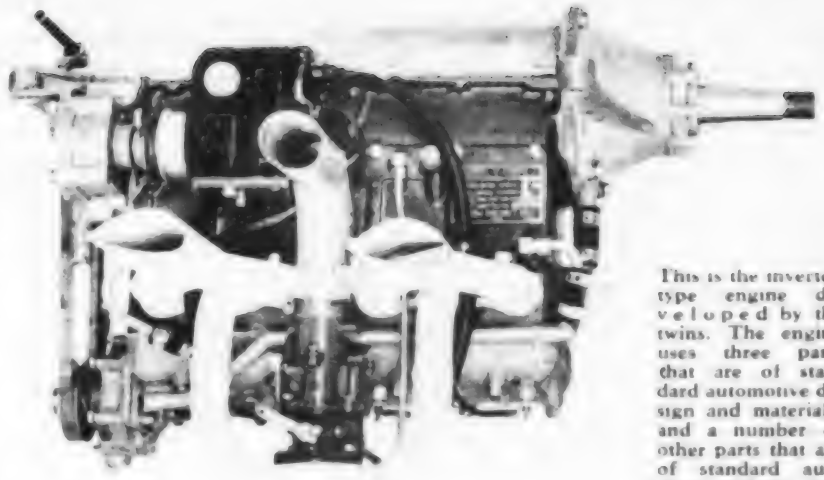
their plane and flew nonstop to Washington. They showed it to the experts at the Bureau of Air Commerce. The government men flew the ship; went over it repeatedly, looking for flaws. Then they asked the boys how much they would charge to build a plane like it for the Bureau. An agreement was made to deliver a ship and two engines.

This second plane was built in the machine shop behind the poultry store. Its performance eventually won the Civil Aeronautics Authority approval. This opened the way to possible manufacture and sale of the Funk plane and engine.

But you can't manufacture and sell airplanes on the proceeds from a poultry store. Joe and Howard Funk had reached a milestone in their methodical plan. They had become experts, respectively, on engines and planes. They had turned out a ship that interested the government enough for it to help them by placing an order. And they had won official approval of the design, and had received their A.T.C. on ship and motor. But they had little money.

The flying fraternity of Akron knew the Funk boys well. Among the pilots who were watching their work was J. H. Bunting, advertising director for an Akron rubber company, and a practical flyer. Bunting suggested that a company be formed and capital raised to manufacture the Funk plane. The boys, who never worried as much about money as they did about building better planes, were skeptical. So were

[*Continued on page* 128]



This is the inverted type engine developed by the twins. The engine uses three parts that are of standard automotive design and materials, and a number of other parts that are of standard auto shape and size, but made to aircraft specifications.

Above: Making wings where school children once did their lessons. William Howe, left, plant superintendent, confers with J. H. Bunting. Below: A corner of the fuselage department, in the schoolhouse-factory basement.

New Method Gets Old Prints

R. F. TIBBETTS, of Los Angeles, shows the apparatus used in his newly developed method of obtaining fingerprints. Tibbetts uses seven kinds of chemically treated powders for the detection of fingerprints on different kinds of paper, and has detected fingerprints on paper 8 years old!

Hot Dogs Get Cooled Off!

THIS pretty girl is enjoying the foot-cool or "Cold Dog Stand" installed at the Carrier Igloo, at the New York World's Fair for the benefit of walk-weary fairgoers. Cool air, circulated by suction fans under the foot panels, is soothingly refreshing to burning bunions! The trouble is getting people to give up their seats at the "cooler."

Bullets Make A Faint Impression

OFFICIALS present at the test of Glenn L. Martin's self-sealing fuel tanks for airplanes examine the holes made in a 44-gallon tank by bullets. The holes were instantly sealed up with little or no leakage of the fuel. An outgrowth of the famous Mareng cell, the Martin tank permits warplanes to become almost impervious to the danger of a punctured fuel tank.

Mechanix Illustrated

Flying Battlesnake

Literally the fangs of the fleet, all-metal fighters such as this are designed to streak from the decks of the plane carriers and drive off attacking bombers. Capable of gaining altitude at the rate of nearly one mile per minute, they would prove deadly in an air duel. This latest of war airplanes is also shown on the cover of this issue.

THE mightiest warrior yet to roar through the clouds, this Grumman XF5F-1 hurls its expertly trained pilot through the air many miles above the earth, at the better part of five hundred m.p.h.! Known as the "Skyrocket," it is lighter by nearly two tons, than other ships of the type and is said to have more power for its weight than any airplane the world has ever known. It is less than 30 feet long.

One thousand two hundred horsepower crammed into *each* of the air-cooled radial engines in its sleek power nacelles, enables the craft to hurtle upward at over four thousand feet per minute—with the motors turning over easily on part power! Two thousand four hundred horsepower drives one man at nearly eight miles per minute!

The very latest advances in aerodynamics are incorporated in the machine. Some features of the plans are based on data which until lately were included in the category of unknowns. The wing, for example, with its square ends, embodies a special design to reduce the hazard of the recently analyzed tip stall of tapered wings. The tail assembly employs two rudders in order to take full advantage of the tremendous propeller blast in producing greater maneuverability without a sacrifice in speed or an increase in weight. An unusually pronounced lateral dihedral on the stabilizer aids in producing the flight characteristics desirable in an airplane of this type.

As a protection for the lone pilot, a rigid post is built up from the fuselage structure at a point directly behind the seat. Housed within the transparent cabin, the post causes no increase in drag, but protects the pilot in the event of a somersault during a forced landing.

The power nacelles extend considerable distance in front of the 42-foot wing, eliminating leading edge disturbances in the propeller discs. The nose of the fuselage proper is located behind the leading edge of the wing, permitting the installation of two relatively

[*Continued on page* 139]

No Fish? Catch A Soprano, Instead!

IZAAK WALTON never suspected the use to which this young man has put his one-piece steel rod-tip. He uses it as an antenna for his car radio. When he reaches the stream, he removes the rod-tip and—presto! There's his fishing pole!

Flashing Photo Found In Foundry

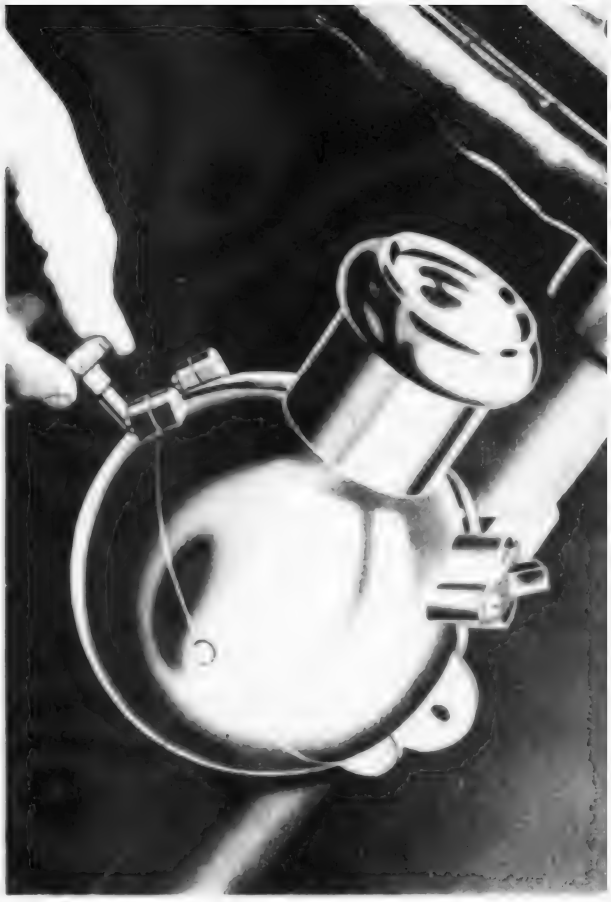
THIS looks like a Fourth of July display, but it's not. It is just what happens when a camera catches the flash welding of two pieces of steel in a large electrical plant. The two semi-circular pieces of steel are being fused into a magnet frame for a direct current motor.

He Can't Jump The Gun!

TAKING a tip from the horse tracks, Ben Ogden, track coach at Temple University, has devised this starting gate that prevents runners from "jumping the gun." When the gun is fired, the straps drop in simultaneous action, and the runner gets away cleanly.

Man Conquers Road Map!

MOTORISTS who have tried to drive and wrestle a folding road map around at the same time will be pleased with this globular map device which fastens to the steering wheel of the car. It consists of a map housed in a metal ball, with a lens to show desired portions at the turn of a knob.



Starting Off With A Bang!

A NEW arrangement for the cartridge engine starter is shown in these two pictures. The old arrangement had the cartridge in the cabin, and many "misfires" resulted, for various reasons. By placing it closer, right on the engine mount, 100 per cent results are now expected. The lower picture shows a close-up of the arrangement.

Boat Bottoms Hit

by Bob Ruskauff

SPEED records on water undreamed of a decade ago will be established in the next few years!

The secret lies, not primarily in the development of power, but in a radical departure from the "conventional" in design of racing hulls.

The parade toward sensational speeds with boats of all classes, regardless of power used or displacement of motor, has already started. The year 1939 saw twenty-one new world and American speed records established in inboard motorboat racing. The spring of 1940 witnessed a half-dozen marks toppled in Florida and Southern California. By the time the motorboaters wind up their record crusades in September, competent observers have predicted that more than 20 existent speed marks in all inboard motorboat racing divisions will be knocked galley west.

For this amazing new increase in speeds, boat designers and racing experts credit what is called a three-point-suspension plan of racing hulls. Virtually every record broken by inboard racing boats in the past year and a half was set by craft designed according to this new principal.

A "three-point-suspension" racing boat might be best described as a hull in which a chunk is simply cut out of the middle, running from bow to stern. By applying proper balance, weight distribution and streamlining the construction to reduce bottom friction, a boat is achieved that has

Little Butch, a record holding racer driven by Brownie Shuber, illustrates use of sponsons in modern racing.

a New High!

Speed records on water have been taking a terrific beating and they're due for even further punishment, thanks to the new construction principle of "three-point-suspension!"

Left: Modern record-breakers roar 'round a turn in a race. Note how the sponsons come into play in present day racing, to prevent upsets on turns and in rough water, without curbing speed on the straightaway.

the attributes of greater speed, always considered the property of hulls with narrow beam, plus the greater maneuverability formerly associated only with beamy boats. It's a sort of "having your cake and eating it" proposition.

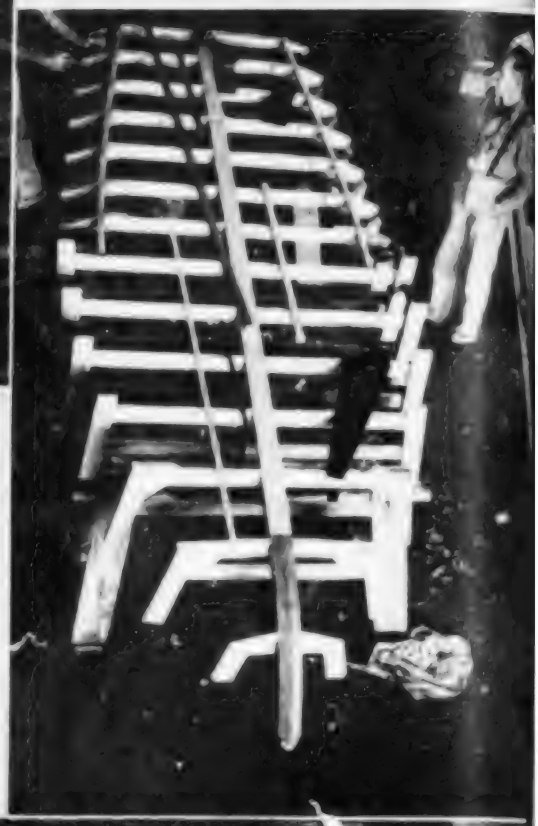
Significantly, the trend toward three-point-suspension design began following the death, on June 13, 1930, of one of the outstanding figures of motorboat racing, Sir Henry O'Neill Seagrave. Driving *Miss England II*, a boat of conventional, narrow beam, Seagrave had set a then-world's unlimited class record run of 98 miles an hour on Lake Windermere. He was attempting to better it when *Miss England II* struck a wake, swerved suddenly, somersaulted and capsized.

The tragedy, one of the few in boat race history, brought starkly to designers this fact: To break further records with boats of conventional hull design was to court death. The faster the boat, the less its maneuverability. Stress in gaining speed had traditionally been placed on increased horsepower. But power plants were already being built capable of a potential speed beyond the hulls made to house them!

Because of this, leading designers were forced to think seriously in terms of three-point-suspension, a decade ago. A number of unsuccessful boats had, in fact, been built essaying the principle, prior to Seagrave's death. It was not, however, until experimentation uncovered a most important adjunct to the new type racing hull that three-point believers got anywhere. This was the

The sponson and bottom design is clearly shown here, on the record-holding Gold Cup racer *So Long*, owned by Lou Fageol, of San Marino, California.

Left: The One-Design racer *Idolon* finishes taking a turn at high speed. Without sponsons, a One-Design race boat had to take turns at half throttle.



Right: This picture shows the first stage in the building of a champion "three-point-suspension" type speedboat; the frames, keel and after chine are in place.

Left: The view toward aft, with the boat planked in, showing how sponsons are framed on the side. These are construction shots of the 135-cubic-inch racer, *Yankee Doodle II*.

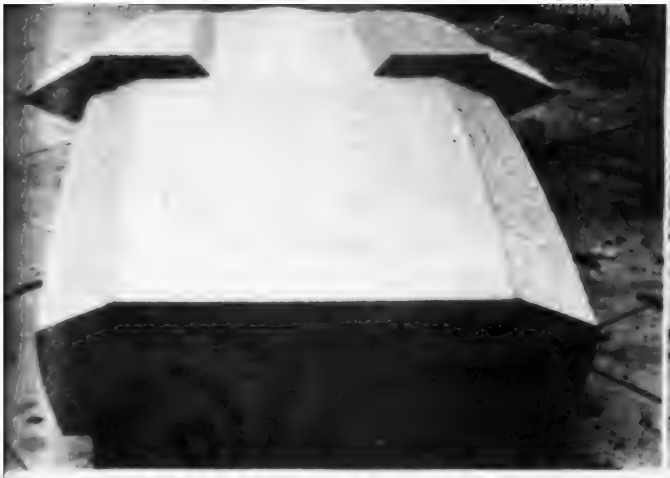
A view forward on the sponson. The sponson is as important in the development of three-point-suspension hulls as a handle is to a pail.

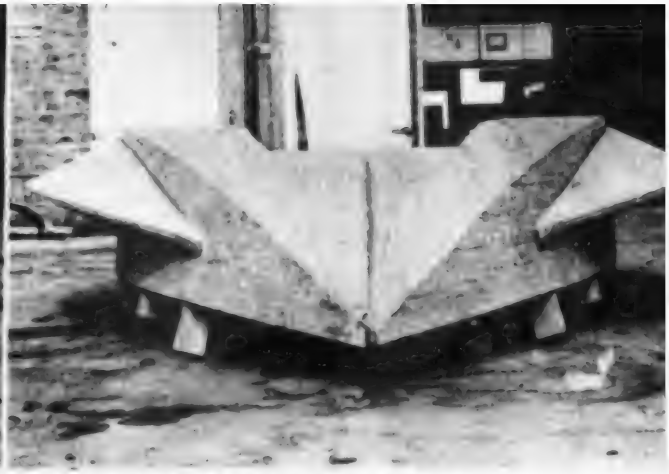
sponson, or relief (safety) chine, an appendage built on either side of the boat, between the mid-section and bow, to help stabilize the craft.

The sponson, authorities agree, is as important in the development of three-point-suspension hulls, as a handle is to a pail. But building sponsons to be effective under all racing conditions proved a tough nut for designers to crack. One of the first boats to use the safety chine effectively was the 225-class inboard racer, *Jericho*. The boat proved to handle beautifully with the sponsons installed, but there was unquestioned loss of speed. Pilot Leroy Golding, an aviator by profession, experimented by raising the relief chine, which had been first set flush with the bottom of the boat, by three-fourths of an inch. The *Jericho* immediately gained five miles per hour in speed, without sacrificing any of its increased maneuverability.

During a recent important regatta on a California course, observers were amazed at the maiden performance of a new boat called *Yankee Doodle II*. Entered in a class at 135-cubic inch motor displacement, powered by a stock 60-h.p automobile engine, which cost $165, the low, rakish 14-foot racer streaked away from a fast field of boats in her class. The boat then went into competition of the 225-cubic inch division, whose motors rated full 90 cubic inch greater displacement, and with the same astonishing ease spread-eagled the field.

In trial spins on straightaway the *Yankee Doodle II* has hit a speed of 67 m.p.h. Her designer, Roy McCullough, a veteran Long Beach, Calif. racer and amateur designer and her driver, Clay Smith, demonstrated the craft was not only strictly stock in motor, but using a second-hand propeller not especially





At the left is the view forward with bottom and sponsons planked. At the right is the view aft. The "chunk cut from the middle" plus the sponsons is the sole difference in appearance from conventional type hulls

adapted to aid in peak performance was capable of turning 63 m.p.h. Yet there was no secret in her design. The *Yankee Doodle II* typifies the sensationally fast new hulls being introduced to marine race courses, which embody the latest features of three-point-suspension.

In building of the boat, McCullough said:

"We had to consider first the American Power Boat Association-National Outboard Association rules. These were designed for a main purpose of providing safety for drivers, by discouraging freak designs. In other words, any shingle might make a world straightaway record, but the rules demand boats capable of competitive racing. They provide that a straightaway mark must be substantiated (with current exception of the unlimited class) by that boat placing no worse than third in recognized competition during the regatta in which the time trials were run."

McCullough believes there is as yet no set rules in building a champion three-point boat. He says:

"Due to various weights of hulls and placements of engines, the angle of the riding plane is variable. Some boats are designed to carry weight on the after plane. Some carry on all three planes. Kenneth Harmon's *Zephyr*, which just broke the 400-kilogram International record of 78.116 miles per hour, carries most of her weight on the after plane. In *Yankee Doodle II* we have a balanced weight, divided between three planes. If the craft were weighted with the driver in the cockpit and you put a scale under any one of the three "points"—that is the transom (or stern) and the two sides—you would find the weights

[*Continued on page* 140]

A closeup of the finished boat at rest on the water. Trial spins have turned up a speed of 67 m.p.h

Machine Gunners Shoot Clay Pigeons

CLAY pigeon shooting has been introduced by the Royal Air Force as an important part of the airgunner's training. After a short period of practice pupils are said to become most accurate. The gunner enters a mobile gun turret, a replica of the gunner's cockpit in his plane, and from this he operates a machine gun to score as many hits as possible after the clay pigeon has been released from a trap.

At Long Last—A Non-Skid Egg Beater!

MANY an inexperienced person who has upset the bowl when trying to beat eggs will find delight in the latest gadget to make kitchen work a privilege and a pleasure. It's a "non-skid" device that attaches to the bottom of the framework of any egg beater. It is made of rubber, and not only does it prevent the egg beater from jumping about, but it also saves the bottom of the bowl from scratches. It is said to be equally successful in the whipping of cream.

Teeth Cleaning Fun With Electric Brush

AFTER three years of clinical testing, this new electric toothbrush has been put on the market. It is said to be the only tooth cleansing device available that automatically performs the rotation type of tooth brushing and gum massaging which dentists recommend. Power for the brush is supplied by a shockproof motor. The device may be used by the whole family, since any standard toothbrush fits in the holder clip.

Fingerprints Feel The Feminine Touch!

IN ONE of the world's strangest schools, young women are preparing for careers in fingerprinting under the guidance of a woman expert. They feel that a civilian fingerprint system will soon go into effect, creating thousands of new jobs for Civil Service, hospital and industrial workers. Positions of this type are already available.

Mrs. Mary E. Hamilton, director of the New York School of Finger and Foot Print, doesn't close her doors to

[*Continued on page* 139]

Above: Mrs. Mary E. Hamilton was New York City's first policewoman. Today she conducts a unique fingerprinting school. Right: With the help of a doll model, students show how a newborn baby is footprinted.

Above: Showing the hand a few seconds before a fingerprint impression is made. Right: One of the students operates a slide machine, projecting the enlarged photograph of a fingerprint on the classroom wall. The class gazes attentively upward.

Seals With a Sheepskin!

by Eugene Pawley

Making their mark in the highly competitive world of entertainment, the old grads of Seal College have brought gold and glory to their Alma Mater. Here's the story of the school that made them famous!

IN THIS educational age, when a ditch-digger with a university degree is the rule rather than the exception, it should not surprise anyone to learn that there is a college at Kingston, N. Y., dedicated to the higher education of performing seals. A co-ed institution, the Seal College is serious about its mission, and has no undergraduate playboys, no junior prom and no football team. It is run by a gentleman named Mark Huling.

The seal is coming back into his own these days and, in Mr. Huling's opinion, this resurgence can be traced almost directly to the institution of learning at Kingston. Sharkey, the Seal College's most famous old grad, is now appearing on

Ted, one of Seal College's star pupils, receiving instructions from Mark Huling. Looks like Ted is talking back!

Seal College's most famous graduate, the talented Sharkey, lunches with three of his colleagues in the Broadway show "Higher and Higher." From left to right, Sharkey, Jack Haley, Shirley Ross and Marta Eggert. Below: Jumbo does the difficult feat of balancing a glass of water while rolling over.

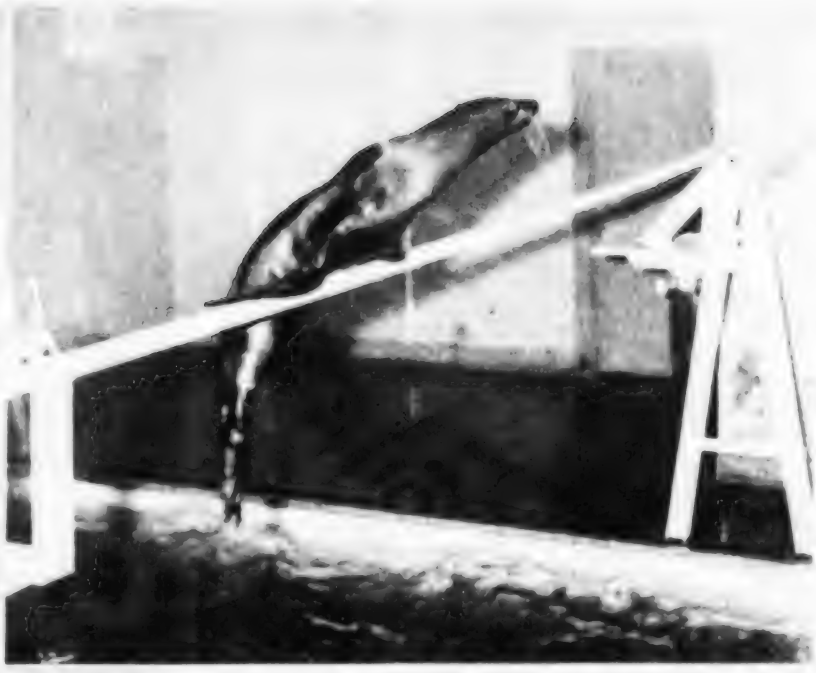
Broadway in the musical show "Higher And Higher"—in which he is co-starred with Mr. Jack Haley, of the films—and another musical, now in the works, also expects to employ a seal or two. In addition, the current rebirth of vaudeville is expected to step up the demand considerably for highly-trained mackerel snatchers. No less than four of Mr. Huling's pupils now enjoy booking.

Sharkey's role in "Higher And Higher" is not exactly a fat one. About all he has to do, histrionically, is slither up in back of the comic Mr. Haley and bite that gentleman in the traditionally funny part of man's anatomy. However, because a seal's education never ceases, Mr. Huling spends the time between the acts teaching Sharkey new stunts, and Sharkey—quick to test his new knowledge—invariably trots his newest trick right out onto the stage with him. As an ad-libber, the seal is alleged to be outdone only by John Barrymore.

Actually, Broadway backstage is not the best place in the world to train a seal. The formative years, according to Mr. Huling, are best spent at Kingston, where he and his partner, Wal-

Right: A student at Seal College learns to walk the tight rope, using a pipe as the first step.

Below: Sharkey, on his best behavior, is taken for a backstage stroll by Miss Narine Hickey.



ter Jennier, are tutoring a total enrollment of eight students. That they are successful can be seen from the fact that the seal when caught will bring only $100 to $200 in the open market, whereas, with a Huling-Jennier diploma in his pocket, he is worth up to Five Grand, as they say along sealdom's Broadway.

Huling's pupils, in reality, aren't seals at all; actually they are sea lions, imported from California, where they are caught off Catalina by a man named Captain George McGuire. According to Huling--and he says other seal men concur in this—seals themselves just aren't built for a theatrical career. True seals are short and fat, and their necks are so stumpy they can neither juggle nor throw a ball. The sea lion, on the other hand, takes to the grease paint like Gypsy Rose Lee; he has a long supple neck, a lithe body, a nice quantity of nervous energy and a disposition that is four-out-of-five parts temperament, enough to make him an ideal Thespian.

It is just this temperament that makes a seal (as we will call these sea lions) a hard individual to train. He is highly sensitive and you just have to clip him once on the snout and he would be through with you forever. As a matter of fact, a cross word or even a frown is enough to make a seal call it quits, theatrically, for all time. Patience is the stock-in-trade of the seal trainer, and according to Mr. Huling, that's what the student gets at dear old Seal College.

One of the little tricks a seal employs when he's piqued, for example, is to launch himself on a hunger strike. Huling and Jennier lost a promising pupil to starvation in the beginning, just because they didn't know this particular quirk. It seems that seals, in their native surroundings, are accustomed to feed on live fish and, as a consequence, they refuse to be fed. Huling overcame this difficulty by tying a fish—not too securely—to an ordinary piece of string and dragging it back and forth in the big pool (which is the main arena for the daily lessons at Kingston). Once the seal had eaten this bait, he apparently became convinced that all fish dumped into the pool were as active as the one on the line—and he thenceforth ate his fill.

Each seal consumes from 8 to 10 pounds of fish daily, and, since he won't perform until fed, he gets a light lunch before and after his routine. The training tank at Kingston is ideally suited to the actual conditions met behind the footlights, being bordered on both sides by tiers of seats which will accommodate approximately 200 spectators. Thus, a seal leaves the college much more able to cope with the hard knocks of his immediate world than

Who said a seal has a tough life? We see that gadabout, Sharkey, above, being pushed around the Radio City roller skating rink by an octet of pretty skaters, while in the picture at the right, Alf enjoys his audience of bathing beauties.

is the graduate of some more well-known university.

In Mr. Huling's opinion, the seal is more intelligent than a dog. He is quick to learn a trick, and once he learns it, he never forgets it, being rivalled, in this instance, it is said, only by the elephant. Mr. Huling likes to get his subjects at approximately the age of five, that being the age of consent among seals. They pick things up quickly at this tender stage, Mr. Huling says, and being more intelligent than any other animal performer, they will master 15 to 20 tricks in no time at all. What is more, after the seal has learned his routine, he will learn new stunts at an average of one a week. Furthermore—and, in this the seal apparently tops even his human competitors—once he has learned a trick, it belongs to him exclusively. No seal ever will imitate another seal.

Huling learned all he knows about seal-training during a twenty-one-year stretch with Barnum & Bailey, but he is like all other seal trainers in that his methods are a professional secret. He will let you sit in on his act, but he won't teach his stars any new stunts during the recital, and you will come away convinced that you've seen a great show, but learned very little.

All that's known is that a seal gets about a half-hour of training a day and a great deal of the schooling consists of teaching the pupil to unmaster the tricks he already has mastered. Paradoxical as this may seem, it derives from the fact that, because the seal learns quickly, he is inclined to do his act just as quickly, giving the audience the idea that his routine, no matter how difficult, is as easy as eating pie. This, naturally, will never do, and Huling must concentrate—once the trick is mastered—in inculcating a little showman-

[*Continued on page* 130]

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3. THIS OFFER closes August 1, 1940.

You're RIGHT—That's WRONG!

Here are 25 statements, some of them true, the others false. The trick is to separate the *true* statements from the *false* ones—and it isn't as easy as it looks! Use a pen or pencil and check the correct box under each statement and see how you make out! After you've given yourself the test, try it out on friends and other members of the family and compare scores. They'll enjoy it and so will you.

Are you ready? Let's go!

1. In Mexico the common cockroach bears the magnificent name "cocobolo."
   True ☐ False ☐

2. Even today a great many tailors use gooses in preparing clothes for their customers.
   True ☐ False ☐

3. Insects do a large part of the work in the manufacture of the woodworkers' stand-by, shellac.
   True ☐ False ☐

4. The coral snake is a vicious deep-sea eel inhabiting the caverns of coral reefs where it will attack and sting anything that comes within its range.
   True ☐ False ☐

5. A cygnet is not a multicolored tropical insect but a young swan.
   True ☐ False ☐

6. A cowsucker is a milking device that makes use of centrifugal force in extracting the milk.
   True ☐ False ☐

7. A glutton is a small mountain cat, about two and a half feet long, living in northern Europe and Asia.
   True ☐ False ☐

8. A rose engine is a lathe attachment used to produce decorative designs on metal.
   True ☐ False ☐

9. John Paul Jones, American naval hero, was not named Jones.
   True ☐ False ☐

10. Aspirin is known to the chemist by the longer term "trinitrotoluene" which describes its actual chemical structure.
    True ☐ False ☐

11. A Western Union Splice is a marriage performed by telegraph with the bride and groom in different cities.
    True ☐ False ☐

12. Unlike automobiles, airplanes do not have a clutch or a gear shift lever.
    True ☐ False ☐

13. An isolated typhoid germ is known to the scientific world as a typhoon.
    True ☐ False ☐

14. The thesaurus was a prehistoric lizard weighing more than four tons and measuring more than one hundred feet from head to tail.
    True ☐ False ☐

15. Two cycle gasoline engines are lighter than four cycle engines of the same power because they have fewer parts.
    True ☐ False ☐

16. A propeller spinner is an apprentice mechanic at an airport.
    True ☐ False ☐

17. The first skis were made with wooden frames covered with leather.
    True ☐ False ☐

18. All sloths do not have the same number of toes on their feet or the same number of vertebrae in their necks.
    True ☐ False ☐

19. Spoilers are devices used to increase the wind resistance of airplanes in flight.
    True ☐ False ☐

20. A fire tube boiler is one in which the flames and hot gasses pass through tubes in order to heat the water in the boiler.
    True ☐ False ☐

21. Whippletrees are marsh plants growing in northern Canada.
    True ☐ False ☐

22. The object of the filters placed over camera lenses is the exclusion of dirt and dust from the shutter.
    True ☐ False ☐

23. When a radio is "motorboating" the grid leaks must be caulked.
    True ☐ False ☐

24. When a person becomes violently insane as the result of immersion in salt water, he is known to the psychiatrist as a sal ammoniac.
    True ☐ False ☐

25. A porringer is an edible salt water fish, usually five or six feet in length.
    True ☐ False ☐

WHAT'S YOUR SCORE?

To get your score, simply give yourself 4 points for every question you answer correctly and total the result. If your mark is above 90, you are exceptional; if it is between 80 and 90, you deserve high praise; if it's between 70 and 80, you're good; between 60 and 70, fair; and below 60—well, try again next month!

Answers will be found on page 137

20,000 Years Makes Lamps a Lot Brighter!

HELEN ADAMEK, of New York City, holds a lamp which scientists claim is 20,000 years old, while she sits beside the largest incandescent lamp in the world. The ancient lamp, made of stone, is capable of seven-tenths of a candle power; its powerful descendant shines forth with the brilliance of 175,000 candles! Both lamps are being exhibited at the Electrical and Steam Building, at the New York World's Fair.

Two More Negatives Bite The Dust!

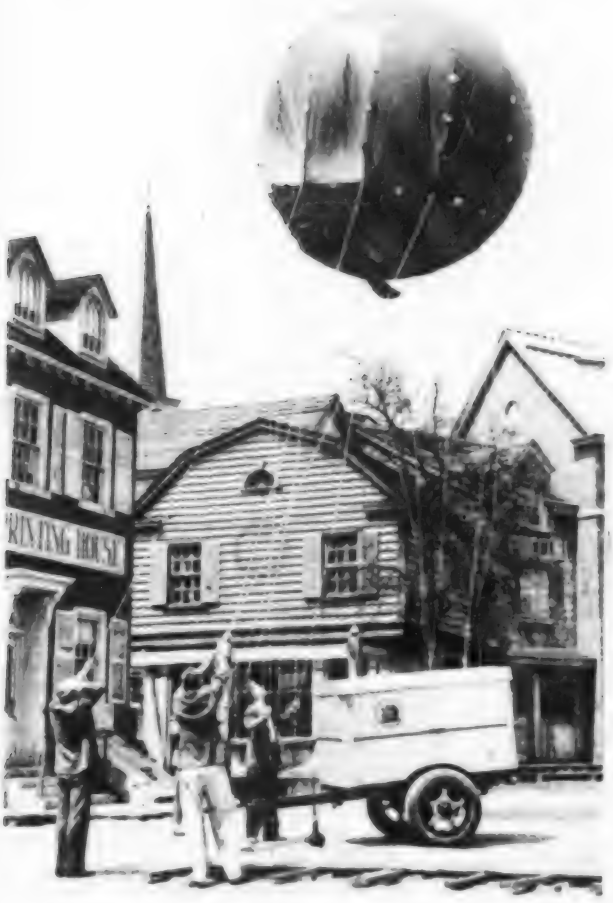
A TWO-GUN man is Sharpshooter Joseph Bracco of the New York Museum of Science and Industry staff. He's indulging in a bit of target practise with two pistol cameras from the Eastman Historical Photographic Collection, now on exhibition at the Museum. Popular around the turn of the century, these cameras have their lenses incorporated in the barrel of the "pistol," while the film is contained in a roll in the cylinder.

This Plow Turns A Straight Current!

THE North Saskatchewan River, in western Canada, is deep and swift, and three or four times a summer sandbars drift in and pile up overnight. When they are in the path of the ferry it cannot cross, and the only solution is to plow up the sandbars, loosening the sand and letting the current carry it away. It's dangerous work, for once off the sandbar, the water is deep and swift. The horses can endure the icy water for only a few hours.

Balloon Gives The High Sign!

IN THE language of the air, a big orange-colored balloon now means: "Quiet, Please!" Hollywood studios have worked out a project for "clearing the skies" within three miles of a studio making a picture. It consists of sending up a captive balloon of brilliant orange, with silver reflectors on the outside.



Hose Does Double Duty

SOLUBLE solutions, such as plant food, fertilizer, fungus control and insecticides can now be easily applied while sprinkling plants with water. Operating on the siphon principle, the flowing water to this hose draws the solution from a bucket, and distributes it evenly over the lawn or garden.

Army Tests New Diesel Aerial Engine

RECENTLY tested by the U. S. Army, this new Diesel airplane engine is shown installed in a Stinson "Reliant." Looking it over are S. A. Guiberson, president of the Guiberson-Diesel Engine Company, and his son, Allen. The Guibersons claim it will give 50 per cent greater cruising range than gasoline engines.

Causing cave-ins and fissures, erupting in smoking craters that dot the Ohio hillside; New Straitsville fire has destroyed coal worth $55,000,000.

A veteran miner, employed by WPA on the mine fire sealing project, is well-prepared to battle the blaze. Below: Intense underground heat caused this hill to crack.

Trapping

IN THE dark night flame still belches forth, glowing red on hill-sides, streaking skywards from deep fissures. Smoke that smells like a sulphurous witch's brew billows upwards, the ground is hot, and crops are seared. The New Straitsville, Ohio, mine fire, greatest in the world, is still raging after fifty-six years, but science has at last conquered it, engineers have finally devised a method of fighting fire with mud, and in a few more months the glowing coals will turn ashen grey and the crystal springs will no longer pour forth hot water.

The tremendous underground inferno couldn't be extinguished, but it could be trapped . . . confined within its 24-square mile area. It's taken a million dollars of WPA

Covering an underground area of twenty-four square miles, Ohio's terrible inferno has raged unchecked for fifty-six years! Here's how the government has finally trapped the world's most destructive mine fire!

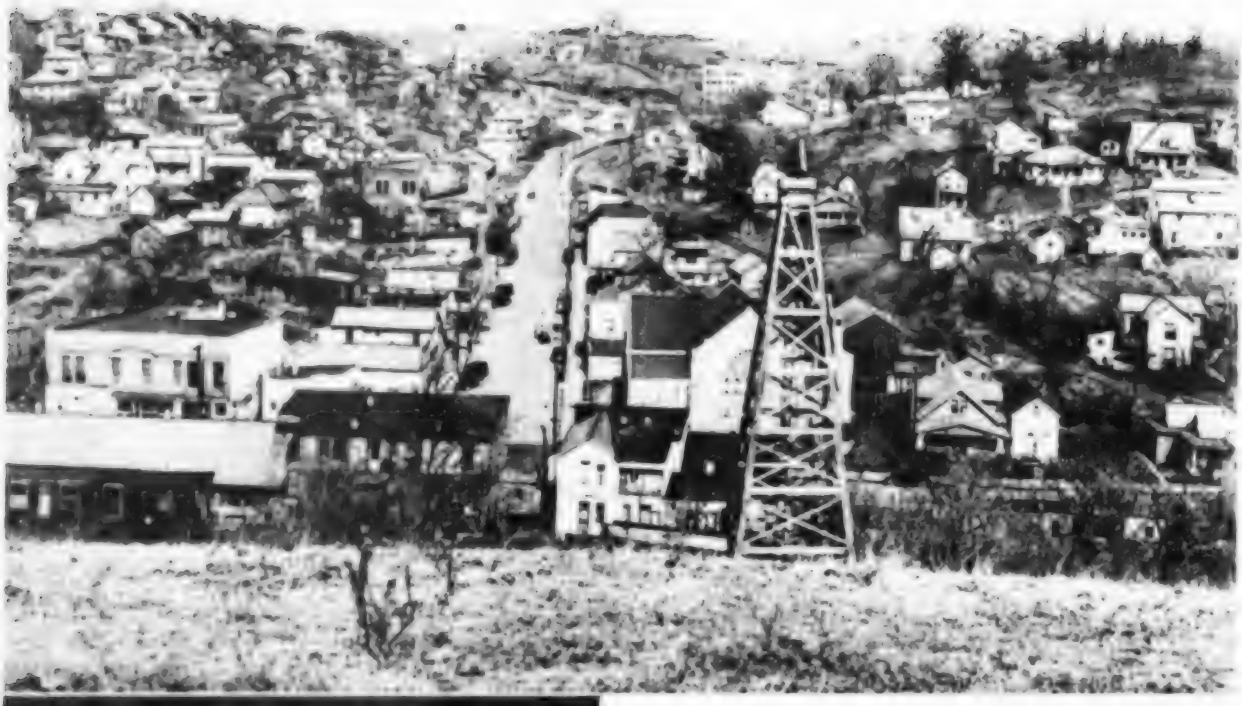
by
John R. Whiting

The FIRES of HELL!

money to do it, but the Hocking Valley coal field is safe now, and man can once again claim a victory over nature, a triumph of mud barriers over crackling flames.

The fire began one June night in 1884, during a bloody coal strike that had already known the whine of flying bullets. The tough embattled miners refused to work for 65 cents a ton of pick-mined coal, and battles with strikebreakers and mine guards were frequent. One night the barracks of 50 Pinkerton detectives broke into flames, and while guards and villagers from New Straitsville watched the excitement, five desperate men set out on a mission of danger, a rendezvous with Hades.

In the shadow of a gaunt mine tipple they whispered last minute plans, shook hands, and separated, bound for the tunnel entrances of each of the five largest mines. More than a mile underground the men found what they were looking for: squat mine cars, made of heavy iron-bound planks. Each car was loaded with heavy timber, saturated in kerosene, and set ablaze in the coal-walled tunnels. The five arsonists made their escape, swearing secrecy. It was several days later that mine officials discovered smoke pouring out of the Plummer Hill mine shaft. Three men took open lanterns and entered the tunnel to investigate. They got as far as a pocket of gas, a tremendous explosion ripped the narrow tunnel, and Death had chalked up three victims.



A view of the town of New Straitsville, Ohio, to which the great mine fire has attracted thousands of tourists. Below: Smoke from fire billows up through a fissure.

Within a week the creeping fire had spread through the goaves—abandoned workings—eating away wooden supports, setting the coal veins on fire. Efforts to put out the fires were unsuccessful, and gradually the whole area became infested with the crawling inferno. Days at a time it would smolder, until a weakened support would fall, and air could rush in through a fissure. Then flames roared high—the natives will tell you stories of sheets of fire 200 feet high, of smoke and steam as high as a skyscraper—and the fire spread again.

Of course, many mines could still be worked, although the miners got in the habit of periodically feeling the walls of the diggings to see how hot they were just to be on the safe side. But gradually property values fell, until rain-stained, dilapidated, forlorn buildings told a tale of a boom-town of 3,300 population aging into a sleepy, ramshackle village of 1,700.

The slow-eating fire undermined foundations of buildings. In half a century nearly a score have been abandoned, including a school and a church. Strangely, the creeping fire's effects often showed themselves with startling suddenness. One night a road sank five feet. At other times farmers who wondered why their corn seemed to be

gathering away put their hands to the earth and felt the heat of the underground fire, white hot ten or twenty feet below in a bed of coal. There are stories of housewives drawing hot water for the Monday washing from once-normal wells, of whole fields blazing as far as the eye could see. You can still see the craters, like giant pockmarks across the earth's face.

When the new schoolhouse in the town was built miners cut a channel around it in the coal foundation so that the fire could never undermine the building. One day a short-circuit started a basement fire in the coal supports and an emergency crew of mine fire fighters barely put it out in time. The residents of the surrounding hamlets came to expect cave-ins and deep fissures almost anyplace, and they grew callous to the danger.

Besides the human misery caused by the mine fire, the economic loss began to mount as decades passed. Engineers put the destroyed coal at 12,000,000 tons, worth $55,000,-

[*Continued on page* 138]

A stone dam straddles a ditch that's part of the Shawnee Barrier, thrown in the path of fire. Below: A miner emerges from one of the mine crevices.

Below: Smoke issues from crevices in the ground in scores of places in the twenty four square mile area the fire covers

Science In Short Pants!

Left: Robert Ray poses with a model of Dr. Beebe's Bathysphere, complete with small-scale reproductions of the interior equipment. Above: Matthew Cohen listens to the "sweet music" of his model electronic organ. The eye, which translates the pulses of light into pulses of organ, built from original plans, starts a light beam which is interrupted at audio-frequency, and strikes an electric electricity which are amplified by an audio amplifier.

These three boys from Providence, R. I., are the makers of this Iron Lung model. It was made from an old gasoline can, with bellows operated by an electric motor.

THE 12th annual Science Fair, conducted by the American Institute Science and Engineering Clubs at the American Institute of Natural History, in New York City, gave hundreds of young research workers from various parts of the country an opportunity to exhibit their models and inventions. The displays covered virtually every subject investigated by man, and revealed a well-rounded student interest in science.

Wind tunnels, models of atom smashers, electric organs and electronic organs were among the novel, originally devised working models displayed. The prize-winning exhibits from this Fair are now on display at the American Institute Student's Science Laboratory of the New York World's Fair.

No Sore Arm For This Pitcher!

INVENTED by Byron Moser this mechanical pitcher is designed to serve up perfect strikes for baseball batting practise. The picture at the right shows Moser loading the hopper with baseballs. Below, he waits for a perfect "pitch."

New Glasses Control Glare Of Daylight

EXTREMELY compact and sturdy, these new Polaroid variable glasses are the modern answer to the need for better eye-protection against glare and excessive brightness. A button at the top of the glasses enables the wearer to control the amount of light that reaches the eye; the world can be as bright or as dark as the wearer cares to make it, merely by adjusting the button.

Hollywood's "ODD JOB" MEN

By dipping long strands of fibre into plaster of paris, Jack Baker, Warner Brother's technician, produces icicles for realistic winter scenes. Below: Wearing out clothes with a spray gun is the strange job of Dick Modor.

PROBABLY no other group in the world is called upon to perform such a variety of tasks as is Hollywood's small but necessary army of "odd job" men.

Some of these men are prop men, some are studio technicians, others belong in the wardrobe departments of various studios, but the varied nature of their work fits them all under the heading of "Odd Job" artists.

They'll do anything from producing icicles to imitating a fire; from making new suits ragged to bringing forth made-to-order lightning at the director's command.

CREATE MOVIE MIRACLES

Left: When the script calls for dead animals the studio calls on Jack Smith to create exact likenesses with wire, cloth, plaster of paris, and hair

Below: Bob "Smokey" Jackson, Twentieth Century-Fox prop man creates smoke for fight arena scenes with his improvised smoke snorter.

Bob Manly, behind the mask, is a specialist in the art of making artificial lightning.

Huge Watch Weighs 200 Lbs.

WEIGHING over 200 pounds with movement, case and stand, this huge handmade ticker can keep perfect time. It took T. L. Miller, of Odessa, Texas, 2,300 hours to complete the device, which is a perfect duplicate of a late model wrist watch. Power is supplied by a small electric motor.

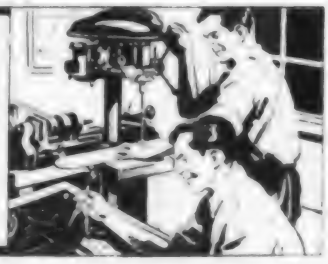
It's A Real "Poker Face!"

DUBBED the Nimatron by its inventor at the Westinghouse Research Laboratories, this complex device is taking on all comers at the New York World's Fair in the ancient Chinese game of Nim, sometimes called "Fan-tan." The machine substitutes rows of electric lamps for the matches usually used in the game.

Diving Helmet Turns Into A Submarine!

JIMMY DALE, Paul McElroy and Emmitt Kelly, of Dallas, Texas, started building a diving helmet last summer, but the idea grew and the boys wound up with this submarine, made from oil drums. The vessel has an underwater speed of four miles an hour and makes eight miles on the surface. It is run by a battery-powered electric motor.

How to Build SECTION

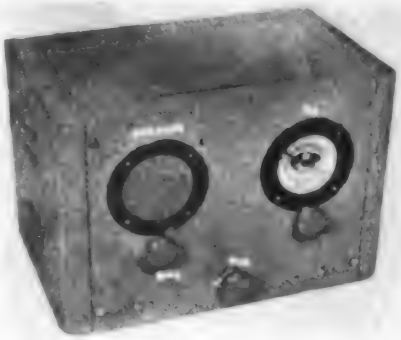


Auto-Spring Crossbow. Powerful, accurate target bow for the amateur archer. Easily and inexpensively built. P. 82.

Model of the month is *Porpoise*, 15-inch gas powered racing boat. Simple, speedy and seaworthy. Plans start on page 86.

IN THIS ISSUE

Pictured here are a few of the selected projects you can build from plans and instructions given in the following pages. In addition, a section devoted to photography starts on page 78.



Listen in to both ends of air-to-ground conversations with the LF-5. P. 94.

Low-Cost Air Conditioner. Can be installed in the average home
Turn to page 107.

MI Special Soap Box Racer. Fast, streamlined racer for general sport or will qualify for Soap Box Derby. Complete plans and article begin on page 102.

Highlight With a

by Arthur Trauffer

Above: Made of aluminum-coated stiff composition board, this reflector unit is easy to replace and cheap to make. Left: Showing how the gooseneck upright attaches to the sliding arm of the stand.

THE compo-flector can be set quickly at any desired angle for highlighting shadow areas. Using one mainlight at a 45 degree angle, this reflector will throw just enough diffused light onto the opposite side of the face to eliminate "blocking up" of this area.

The reflector illustrated is simply a sheet of stiff composition board measuring 1/8x16x22 in., and coated on one side with a good grade of aluminum paint. It is mounted on a flexible gooseneck to allow it to be tilted to any desired angle. The gooseneck is fastened to a telescoping standard so that the reflector may be raised or lowered at will.

The photograph of the model was made with a single light source placed above and to the left of the subject. A reflector was placed on the right side of the subject to throw soft light into the dark areas, providing detail in the shadows and increasing the modeling effect. Naturally, by placing the reflector closer to the subject, the highlighting could have been emphasized.

To build this reflector, you will need the following material:

1/8x16x22-in. piece of Presdwood.
1/16x3 3/4x8 1/4-in. strip of band iron.
A 12-in. long flexible gooseneck.
A hexagon nut to fit threaded end of gooseneck.
1/8-in. pipe coupling.
Two round-head 1/8-in. screws, 1/2-in long. Hexagon nuts to fit.
A telescoping floor stand.

The reflector should be stiff and light in weight, and of a material that will not warp. The writer selected 1/8-in. Presdwood, but one can use sheet aluminum or even a sheet of smooth-sided corrugated pasteboard.

Assuming that 1/8-in. Presdwood is used, obtain a sheet the size given and round off the sharp corners by sawing off the points and curving the edge with a file. Now give the smooth side of the board a coat of good grade aluminum paint. Use a soft and fairly wide brush and apply the paint quickly and evenly. Brush the board lengthwise so that the brush marks will all be in one direction. If you find that a second coat is desirable, apply a thin

Compo-Flector

coat crosswise. This will give a criss-cross pattern of brush marks that will aid in scattering the reflected light rays, thus producing softer and more uniform illumination.

If aluminum is used, remove the polished surface with steel wool, or a kitchen cleanser, and proceed as outlined above.

If corrugated pasteboard is used, it would be advisable to give the board a coat of clear varnish, or shellac, before applying the aluminum paint. This avoids absorption. Then apply the paint as outlined above.

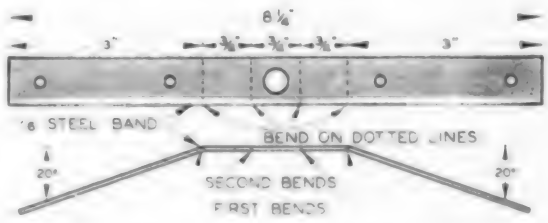
The reflecting screen is fastened to one end of a 12-in. flexible gooseneck by means of a support made of strap iron, or steel band. The strap is bent into a U with a triangular loop in the center of the strap. See drawing. The two outside bends should be made first. Bend the two ends of the band down at an angle of about 20 degrees, then make the two center bends upwards. This will bring the two ends of the band to a parallel position with a space of about $\frac{1}{8}$-in. between them. Now drill a $\frac{3}{8}$-in. hole in the bottom of the triangular loop for the threaded end of the gooseneck. Drill two $\frac{5}{32}$-in. holes through the parallel prongs of the U for the two $\frac{1}{8}$-in. round-head machine screws that fasten the U to the reflecting screen. These holes can be about two inches apart. Now drill two holes through the bottom center of the reflecting screen and fasten the U in position.

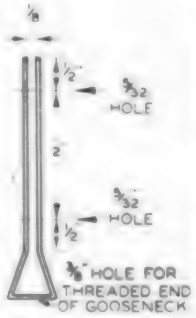
Thread the top section of the telescoping stand and fasten the gooseneck to this section by means of a $\frac{1}{8}$-in. pipe coupling. Fasten the reflecting screen and U to the other end of the gooseneck by means of a hexagon nut, and the reflector is complete.

If you cannot obtain a flexible gooseneck that is stiff enough to support a Presdwood reflector at any angle, the answer is to use lighter weight material for the reflector. If you have the gooseneck nickel plated you will find that its stiffness has been greatly increased. The author had this done for the low cost of 25 cents. Another trick is to insert a 12-in. length of heavy and stiff galvanized wire inside the gooseneck.

If desired, you can make use of the back of the reflector and thus have a choice of two reflecting surfaces

Above: This portrait was taken with the aid of a single light and the compo-flector which served to effectively highlight the shadow side of the face.





Above: Showing details for bending and drilling the metal arm which holds the compo board to the gooseneck. See photo

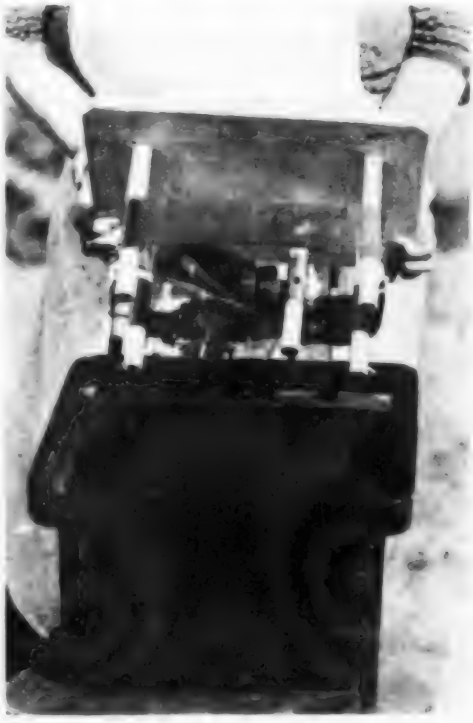
PHOTO KINKS FOR CAMERA FANS

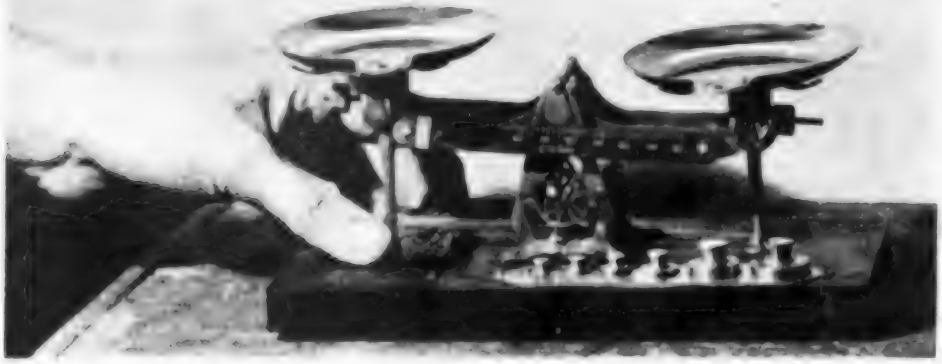
Above: A circular tin candy box with a tight-fitting cover makes an excellent film storage receptacle. Cut a disc of plywood or stiff cardboard to fit inside the box. Cut holes in the disc as shown. Film can be kept in their original containers or wrapped in paper and kept in spaces.—H. Radzinsky

A small bracket attached to the flashgun arm prevents camera from swinging outward. Use copper, brass or aluminum 2½x⅝x1/16 in. Bend up ends of bracket to fit around camera and drill a ¼-in. hole in exact center of bracket. Screw bracket to arm of gun and attach with a ¼-in. bolt. A piece of rubber tubing glued to the bracket will prevent it from scratching the camera.—A. G. Dierks.

Left: This effective retouching aid consists of a piece of stiff cardboard with a hole in it off to one side, as shown. With this aid, negative retouching can be done on a small area through the hole while the remainder of the card serves to block light under the retouching table from striking your eyes. If the hole is made in the center of the card, it becomes less effective.—L. B. Robbins

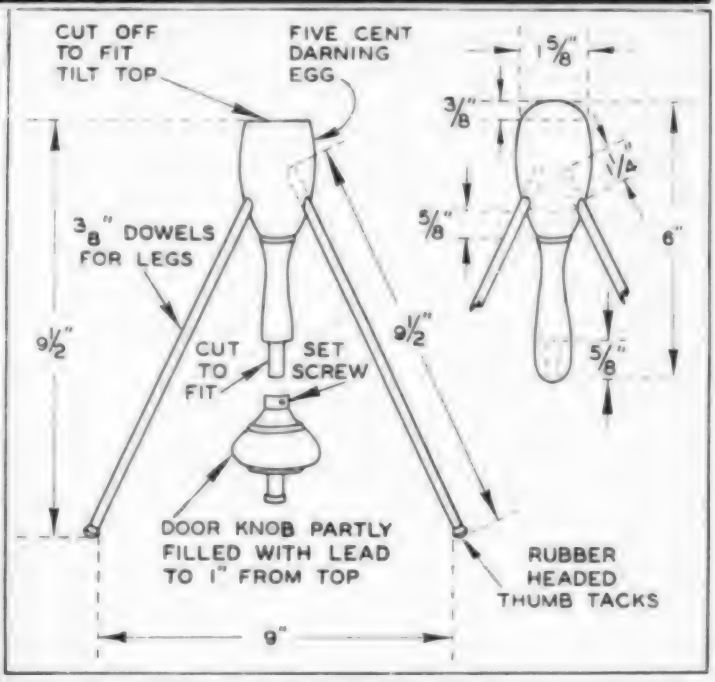
Right: A large plate or cut film tank can be used to develop roll film. Cut a board to fit the top of the tank and fasten ¾-in. wooden dowels in the four corners of the top. Locate a fifth dowel off center, as shown. Drive a wooden peg in the end of each dowel to prevent film from slipping off. Attach a film clip to the center and one end dowel to hold film. Coat wooden parts with asbestos paint.—E. O. Lindemann.





Left: A piece of sponge makes an excellent stop for the type of balance shown. Use rubber from a bath sponge, cut into wedge shape and slide under the cross arm. When forced under tightly, the scale remains in a fixed position. A quicker balance is possible simply by sliding out the wedge to prevent prolonged rocking of the scale. —F. O. Lindemann

TABLE TOP TRIPOD

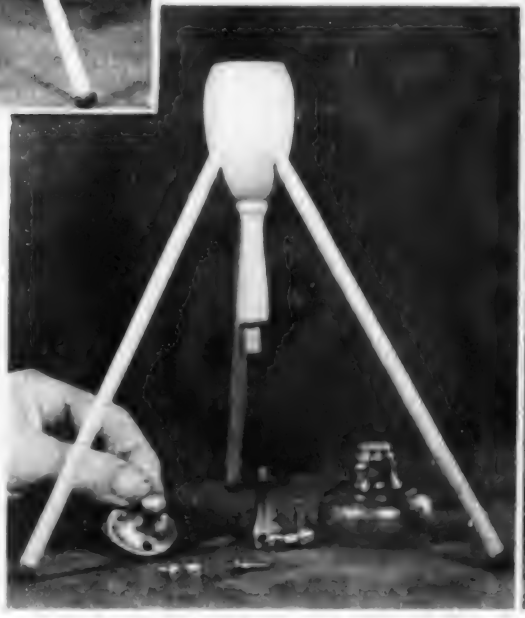


Above: Construction details for making the table tripod from a darning egg. Left: Showing the counter-balanced tripod in use.

by

M. W. Mutschler

THE efficient-looking table top tripod illustrated above can be assembled at a cost of less than a dollar. It features a top that tilts to any angle, wide-spread legs, good working height and a counter-balanced body with a low center of gravity which prevents tip-overs when the camera is at an odd angle.



Above left: Showing the tripod partly completed. Note the few parts ready for assembly. Above right: The darning egg is marked as shown before cutting.

The body of the tripod consists of a 5-cent darning egg altered as follows: Describe a circle around the egg $\frac{3}{8}$-in. from the top and saw off this top to provide a seat for the tilting top. Smooth the sawed edges with a file for a snug fit. A Tiltrite tilting unit was used, but any such accessory will do if it has a flange for fastening to the body of the tripod similar to the one shown in the photo.

Drill three evenly-spaced holes in the flange, counter-sunk on top, and fasten the flange with $\frac{1}{8}$x$\frac{3}{4}$-in. oval round head brass screws.

The penciled circles on the darning egg are for the $\frac{3}{8}$-in. dowels which form the legs

[*Continued on page* 143]

AUTO-SPRING CROSSBOW

by
Bertram Brownold

Modern target practice version of a highly efficient medieval weapon. Simply made of easily obtainable materials, this crossbow is strong and accurate.

A CROSSBOW of surprising power and accuracy can be easily and quickly made of a leaf from an old auto spring and other scrap material. It is copied from the medieval crossbows, which were of two types. The more powerful kind required a windlass to draw the bowstring back over the trigger mechanism; while the lighter type was fitted with a stirrup in which the bowman placed his foot while he pulled the bowstring back with a hook in a wooden handle. It is on the latter type that the crossbow in this article is modeled. While not as powerful as the windlass type, it is far stronger than the usual bow and more accurate for two reasons: the user is under no muscular tension while aiming, and the stock is held against the shoulder, as is that of a rifle.

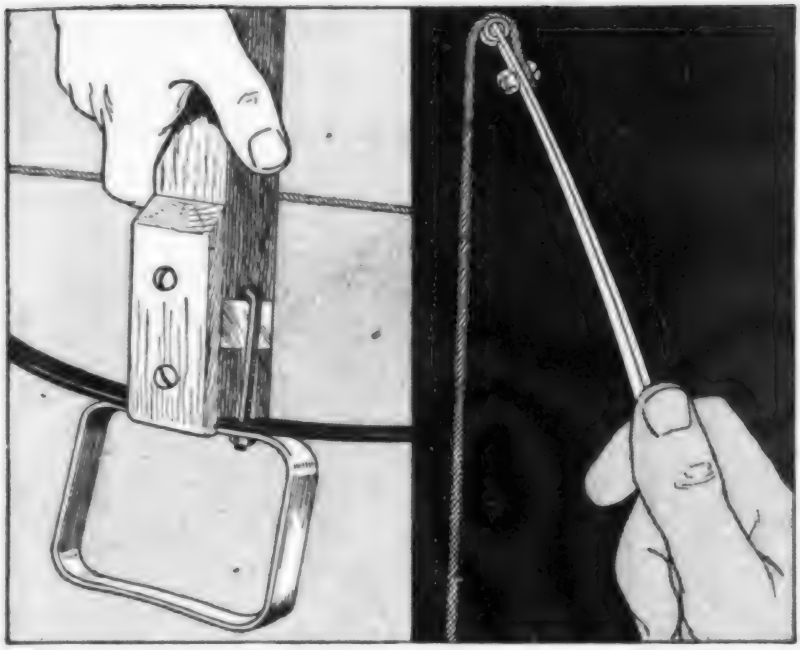
In making the crossbow it is best to string the bow first. The bow shown here is a leaf (measuring 32-in. on the curve) from the spring of an old Dodge car. It is a little less than 2-in. wide, a little more than an eighth of an inch thick at the middle and tapers slightly toward the ends. Any leaf having about these dimensions should do; a larger leaf will be too hard to bend. Most auto junk yards will furnish what is needed.

The bowstring is drawn back to the trigger by means of a short piece of broom handle fitted with hooks

The bowstring is a piece of ⅛-in. wire cable. This cable is looped around two machine screws which are put through holes near the ends of the bow. A piece of split brass tubing is forced over each end of the bow to protect the cable from being bent too sharply. When the bow is strung there should be some tension on the bowstring, and the nuts should be well tightened to prevent slipping.

That part of the crossbow that corresponds to the barrel of a rifle, as well as the stock, are made of two-by-two scrap lumber.

The front end of the barrel is cut on a slant so that when the bow is affixed the bow-



Closeup of the stirrup used in reloading the bow is at left. A long, threaded rod bent into a U-shape holds both stirrup and spring-leaf bow to the stock. Note piece of metal inlaid in stock under threaded rod to keep it from tearing the wood. Right: Wire cable bowstring is looped around a machine screw in front side of bow. A split brass tube guides bowstring around end of bow.

string will clear the top of the barrel.

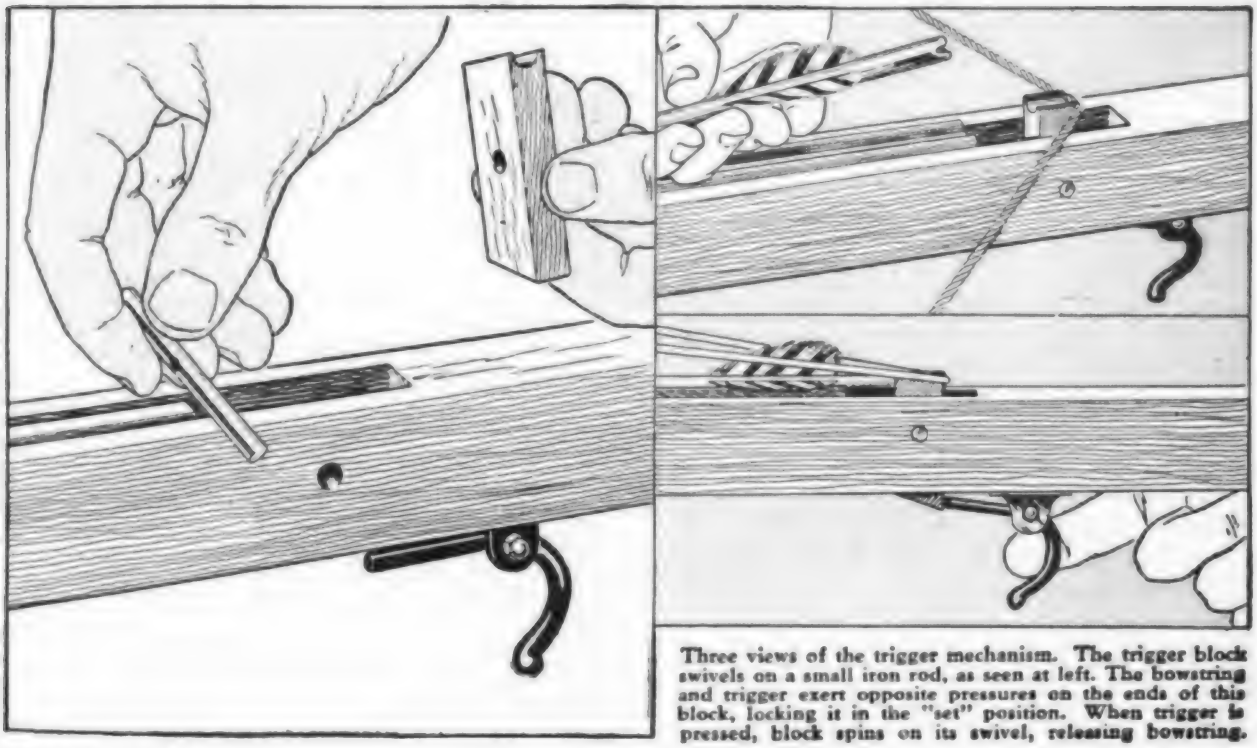
The bow is held in place by a piece of ¼-in. threaded rod which is thrust through a hole drilled in the barrel a few inches from its forward end. This rod is put in straight and then bent forward until it forms a U with square corners. Its two ends are then put through two holes in the bow.

The stirrup (of scrap metal) has two corresponding holes. It is slipped over the ends of the threaded rod after the bow is in place and the assemblage is held together by nuts.

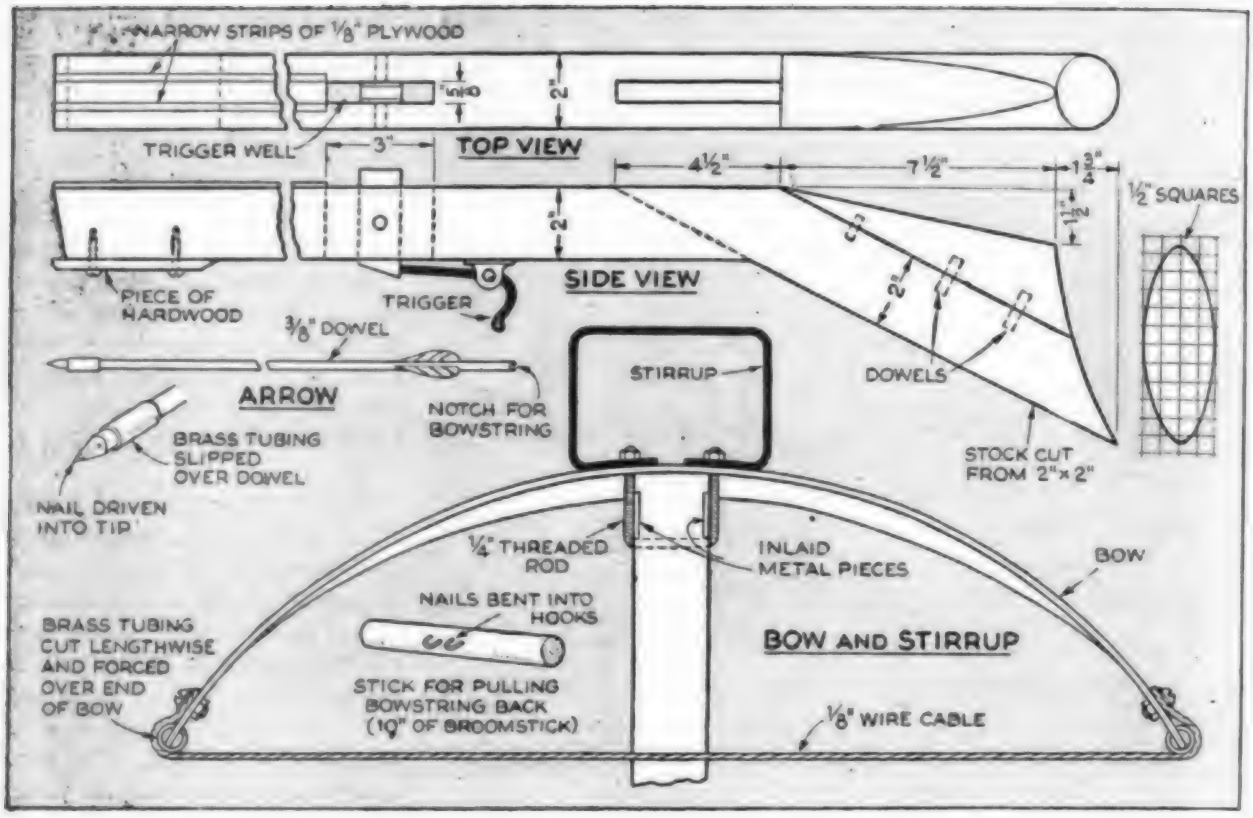
A small piece of hardwood is screwed to the under side of the barrel and projects slightly beyond its forward end to prevent the bow from slipping off the slant; and two pieces of metal are inlaid in the sides of the barrel to prevent the threaded rod from tearing the wood.

Next take a piece of broomstick about 10-in. long and put two heavy nails through it at the center and three-quarters of an inch apart. Bend these nails into hooks. With this the bowstring is pulled back over the well which contains the trigger mechanism. The exact location of the well is determined by how far it is possible to pull back the bow string.

With one foot in the stirrup, and with the butt braced against the body, draw the bowstring as far back as possible, using two hands on the handle of the hook and exerting full strength. A second person then marks the barrel, indicating how far the bowstring has been pulled back. The well, which is 3-in.



Three views of the trigger mechanism. The trigger block swivels on a small iron rod, as seen at left. The bowstring and trigger exert opposite pressures on the ends of this block, locking it in the "set" position. When trigger is pressed, block spins on its swivel, releasing bowstring.



long by ⅝-in. wide, extends forward from this mark. The well, by the way, has no bottom; that is, it is simply a rectangular hole passing right through the barrel from top to bottom.

Revolving freely in the well, on a ¼-in. iron shaft which pierces the well's side walls at their centers, is the "post." The post consists of two plates of $\frac{1}{16}$-in. brass with a piece of ⅜-in. hardwood between, all three members being riveted together. The plates are 1x3-in.; but the piece of hardwood is a half inch shorter, thus allowing room for the end of the arrow to fit between the plates and rest with its notch against the bowstring. The post extends a half inch above and below the barrel and is locked in a vertical position when the crossbow is cocked and ready for use. The trigger blocks its lower end and prevents it from revolving on its shaft; while the bowstring, which has been drawn back and over it, pulls hard against its upper end. The arrow is then placed in position between the two brass plates. When the trigger is pulled the post revolves, the bowstring is released, and the arrow flies.

The trigger can be made of any scrap metal. The one shown here is made from an iron clothes-hook from which superfluous parts were cut with a hack saw. The two pieces between which the trigger pivots are the end brackets of a brass curtain rod. A bit of spring metal in the well presses the post against the trigger.

Two narrow strips of ⅛-in. plywood are glued to the top of the barrel. They are parallel and form a groove for the arrow.

The stock is jointed to the barrel as indicated.

The arrows are of ⅜-in. dowel stick. Care must be exercised in selecting straight dowel sticks, otherwise the arrows will not fly true.

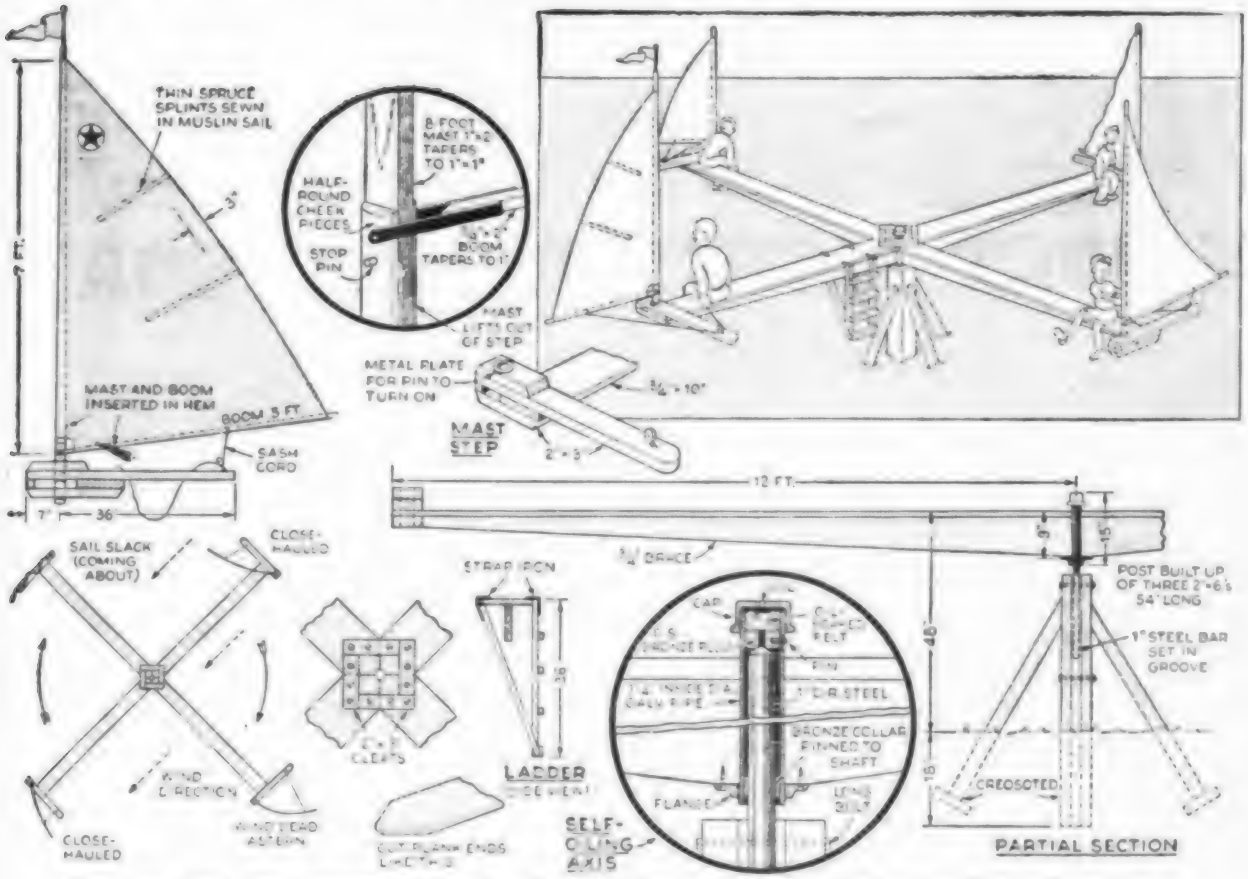
No set rule governs the length of the arrows; those in the photos are of various lengths, but 22-in. seems to give good results.

The end of the arrow is filed with a rat tail file to form a notch that will fit the bowstring.

The feathers are attached with a good grade of quick-drying celluloid cement of the type used in model airplanes. They should be attached about an inch from the end to allow a sufficient length of bare dowel-stick to fit between the brass plates of the post. Feathers all cut and ready may be bought at department and sporting goods stores that carry archery equipment. Should no such store be available, feathers from a feather-duster will do. Cut them 2½-in. long, ½-in. wide at the widest part, tapering to ⅛-in. at the narrow end. Split the quill with a razor blade. After the feather has been so cut and shaped, hold it firmly between two small pieces of plywood or stiff cardboard in such

[*Continued on page* 143]

CATBOAT CARROUSEL



Drawings above show construction details and general design of the revolving sailer. Note sail positions.

PUT those warm winds to work on this fleet of dry-land yachts. Any open space exposed to the winds will be suitable for a location. Construction is simple and the self-oiling axis requires a minimum of machine work.

Make the supporting post of three "2x6's," the middle one ripped and grooved to receive the steel bar, the end of which is turned to a blunt taper. A length of galvanized pipe is fitted with a countersunk bronze plug pinned in place. Fill the space above with felt, and screw on a pipe cap with an oil hole. The lower end of the pipe turns in a bronze collar pinned to the shaft.

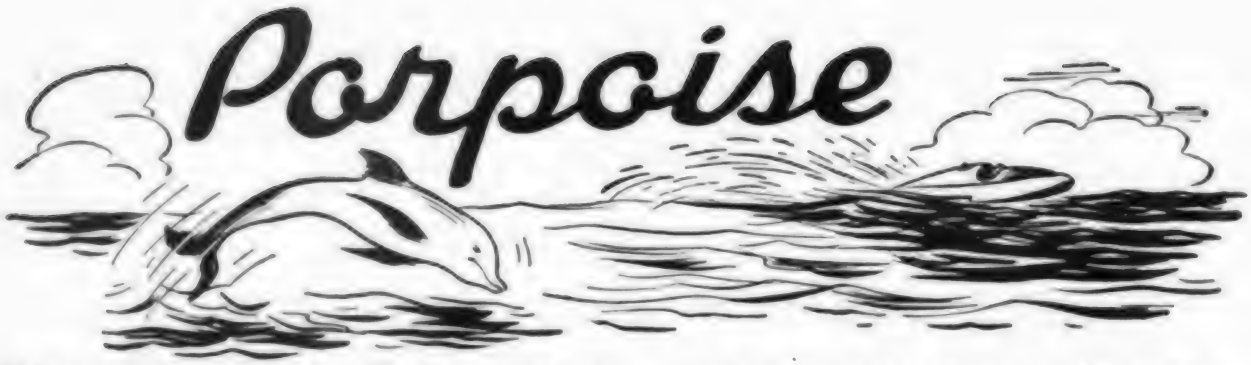
Arms of the device are built up on the galvanized pipe, and by using braces underneath, lighter material than the usual 2-in. planks can be used. To simplify the work, mast and boom are of flat material tapered toward their top ends. Lower ends of masts are fitted with half-round cheeks so that they will turn in the mast steps, and steel stop-pins prevent its slipping through. Sails are made of unbleached muslin with a wide hem to receive mast and boom. When not in use entire mast is simply lifted out and stored.

Note that the revolving arms are well above ground so that the sails may catch the wind. The 4-ft. distance is not at all hazardous for the pilots, at the same time giving them a greater thrill when whirling around under sail.

When obtaining the lumber for the masts it is important that the full dimensions specified on the plans be adhered to. The shingle lathing strips generally known as 1"x2" are not full size. Both mast and boom must be finished to the full sizes mentioned.

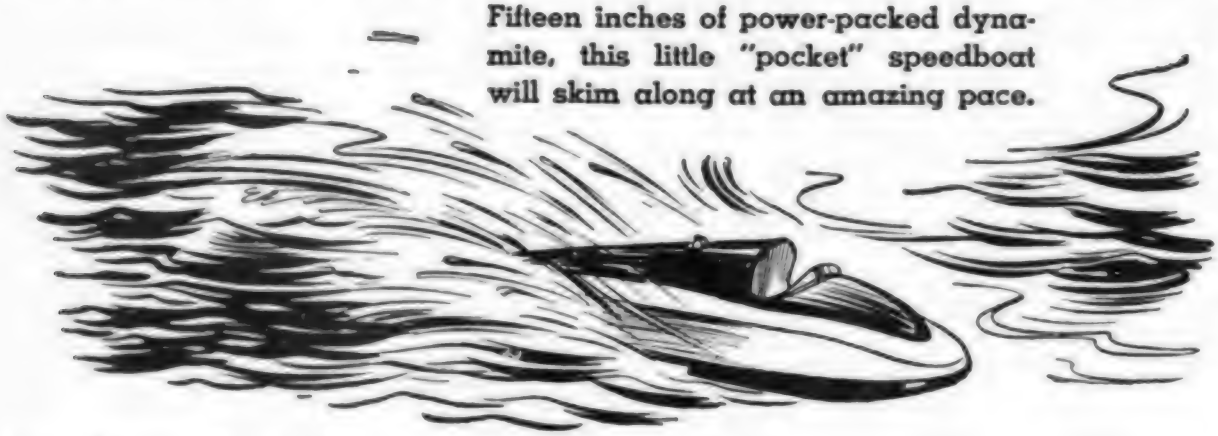
No particular technique is necessary in sewing the sails, as the sail area is not large. A little planning in advance, however, will enable the builder to save considerable muslin by taking advantage of the identical form of the four sails in order to use up short ends.

Although the sailors might easily climb aboard their "ships" without the aid of the ladder, it is wise to include it.—*Hi Sibley.*



MIDGET MODEL RACING BOAT

Fifteen inches of power-packed dynamite, this little "pocket" speedboat will skim along at an amazing pace.



by Alan Orthof

and Nick Limber

WITH the introduction of successful Class "A" gasoline engines, and their universal acceptance by the model enthusiast the realization of "pocket" power boats has at last been achieved. In no time now . . . throughout the country model skippers will be building and racing the new flea-size powerhouses.

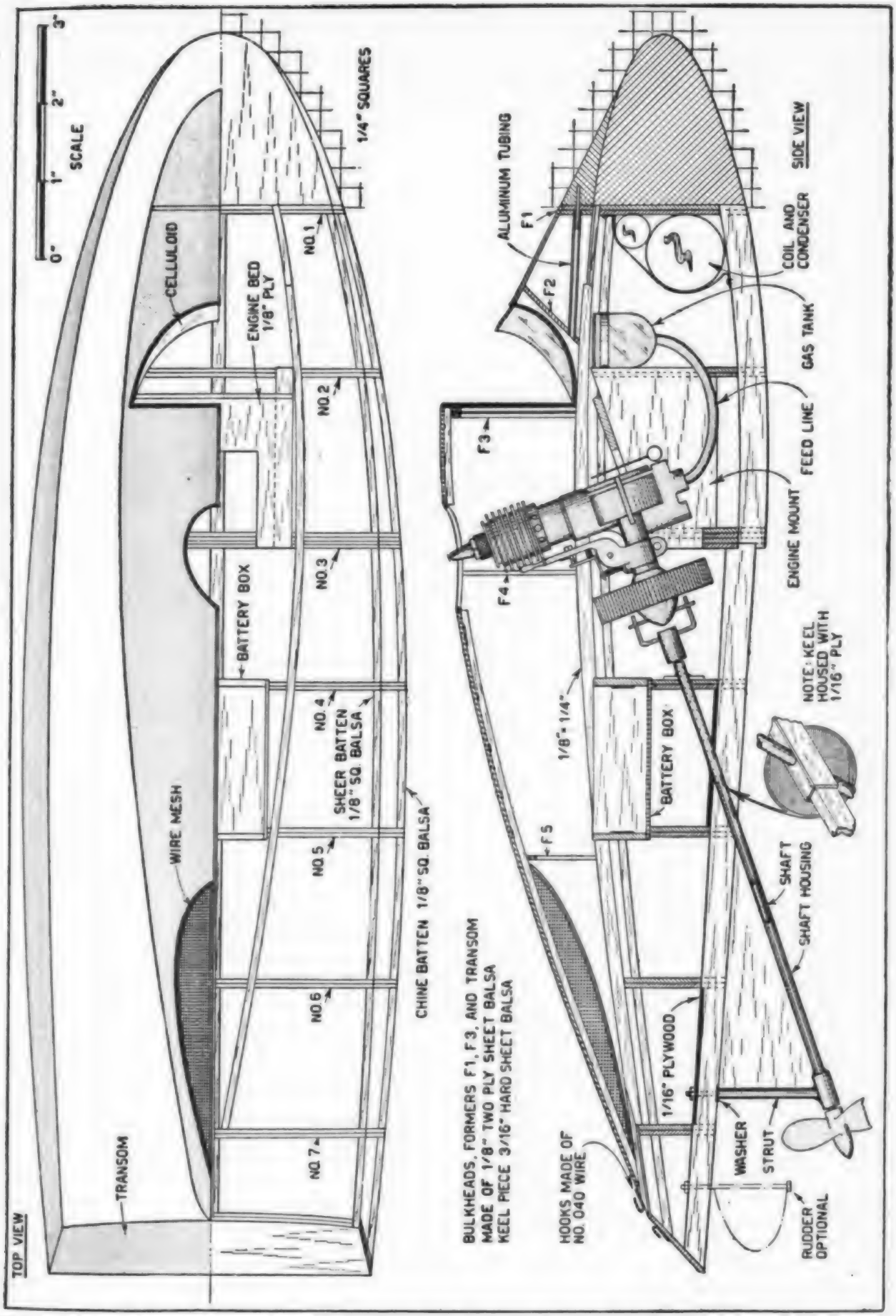
Among the first of these tiny racers, is the *Porpoise*. Light, sturdy, and exceptionally sea-worthy, the craft has been designed for performance and styled for beauty. The compact layout of the operating mechanism has permitted a hull design of minimum resistance to sea and air, with maximum strength and efficiency. A sleek motor housing lends to the trim appearance of the craft and the boat may be run with it in place. The stream of air blowing through the forward mesh provides ample cooling for efficient operation of the powerplant. Easily accessible yet effectively housed, the motor, gas tank, ignition system and other mechanism essential to the operation of the craft, can be reached in event a replacement or repair is necessary.

Easy to build, *Porpoise* may be constructed inexpensively and quickly. Following the instructions, the builder should have no difficulty.

Previous to the construction of the craft, the modeler must laminate the 1/16-in. sheet (see Bill of Materials) and allow it to dry over a period of at least five hours. Model airplane cement is used to hold the

BILL OF MATERIALS

5 sheets 1/16"x3"x36" hard balsa, formers, etc.
1 sheet 1/16"x2"x18" hard balsa, keel.
18 strips 1/16"x 3/8"x36" hard balsa, planking.
5 strips 1/8" sq. x 36" hard balsa, chine and battens.
1 block 2 1/2" sq. x 3 1/2" hard balsa, nose block.
1 sheet 1/8"x2"x3" plywood, motor bed.
1 sheet 1/16"x2"x3" plywood, battery box sides, etc.
1 sheet 1/4"x2"x5" pine, motor mounts.
Small sheet .030 brass shaft housing plate, etc.
5/32" outside dia. brass tube for shaft housing.
1/8" brass rod for shaft.
Small length 1/4" outside dia. brass tube for universal joint and strut bearing.
Small length 1/16" steel wire for universal joint.
Small length .040 steel wire for hooks.
5 feet spaghetti tubing for cockpit outline, etc.
Wire mesh for radiators.
4 ozs. cement, 8 ozs. clear dope, colored lacquer to suit builder, 1/2 yd. silk, 2 sheets tissue, small tube plastic wood.



Top view showing frame half covered and half uncovered, and cross-section profile giving details of motor installation.

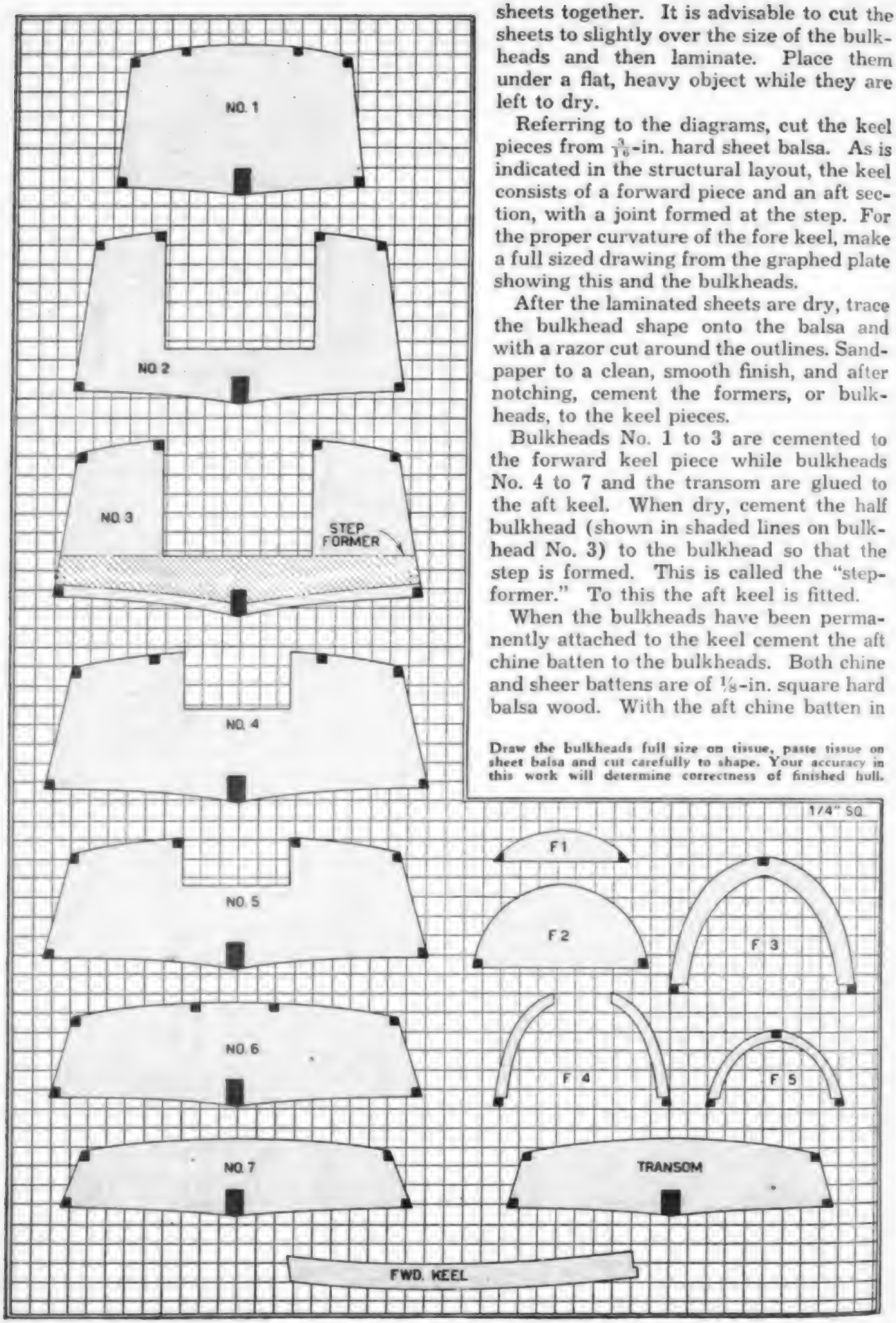
sheets together. It is advisable to cut the sheets to slightly over the size of the bulkheads and then laminate. Place them under a flat, heavy object while they are left to dry.

Referring to the diagrams, cut the keel pieces from $\frac{3}{16}$-in. hard sheet balsa. As is indicated in the structural layout, the keel consists of a forward piece and an aft section, with a joint formed at the step. For the proper curvature of the fore keel, make a full sized drawing from the graphed plate showing this and the bulkheads.

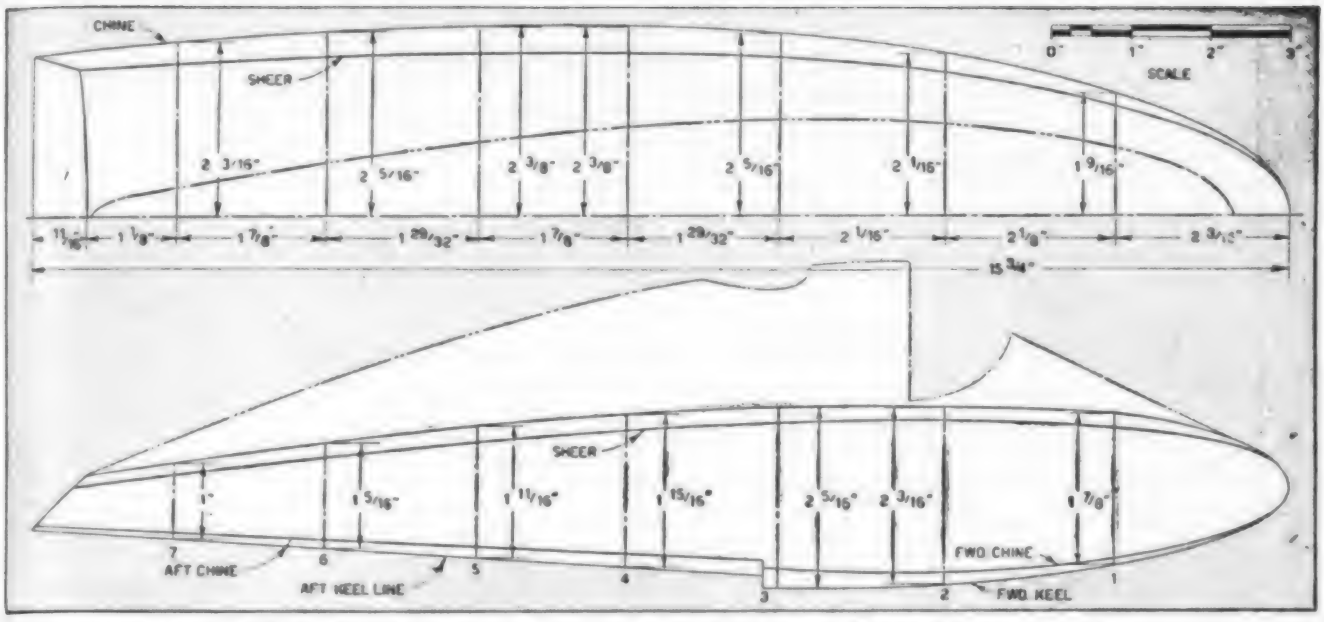
After the laminated sheets are dry, trace the bulkhead shape onto the balsa and with a razor cut around the outlines. Sandpaper to a clean, smooth finish, and after notching, cement the formers, or bulkheads, to the keel pieces.

Bulkheads No. 1 to 3 are cemented to the forward keel piece while bulkheads No. 4 to 7 and the transom are glued to the aft keel. When dry, cement the half bulkhead (shown in shaded lines on bulkhead No. 3) to the bulkhead so that the step is formed. This is called the "step-former." To this the aft keel is fitted.

When the bulkheads have been permanently attached to the keel cement the aft chine batten to the bulkheads. Both chine and sheer battens are of $\frac{1}{8}$-in. square hard balsa wood. With the aft chine batten in



Draw the bulkheads full size on tissue, paste tissue on sheet balsa and cut carefully to shape. Your accuracy in this work will determine correctness of finished hull.



Lines drawing above gives distances between bulkheads, as well as their heights and half-widths.

place attach the forward chine and sheer battens. Pins are used to hold these to the bulkheads until the cement has hardened.

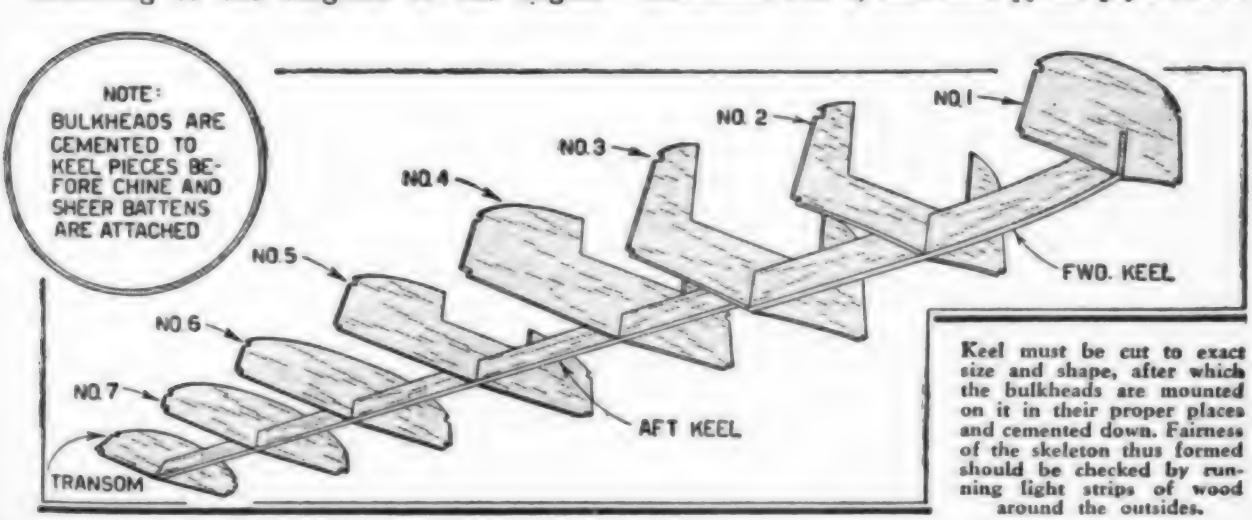
Note: The builder is cautioned against attaching the battens to the bulkheads until the bulkheads have been firmly attached to the keel pieces and the cement has completely hardened.

Using $\frac{1}{16}$-in. hard balsa, cover the bottom of the boat. First the aft section is covered, then the forward. The covering is applied in four panels, with the seam falling along the keels and step. To maintain the curvature of the bottom, pins are used to hold the sheet to the bulkheads. With a sharp razor the panels are trimmed to the chine line and the side panels are cemented into position. The sides of the hull are also of $\frac{1}{16}$-in. hard sheet balsa. These are trimmed and finished with sandpaper.

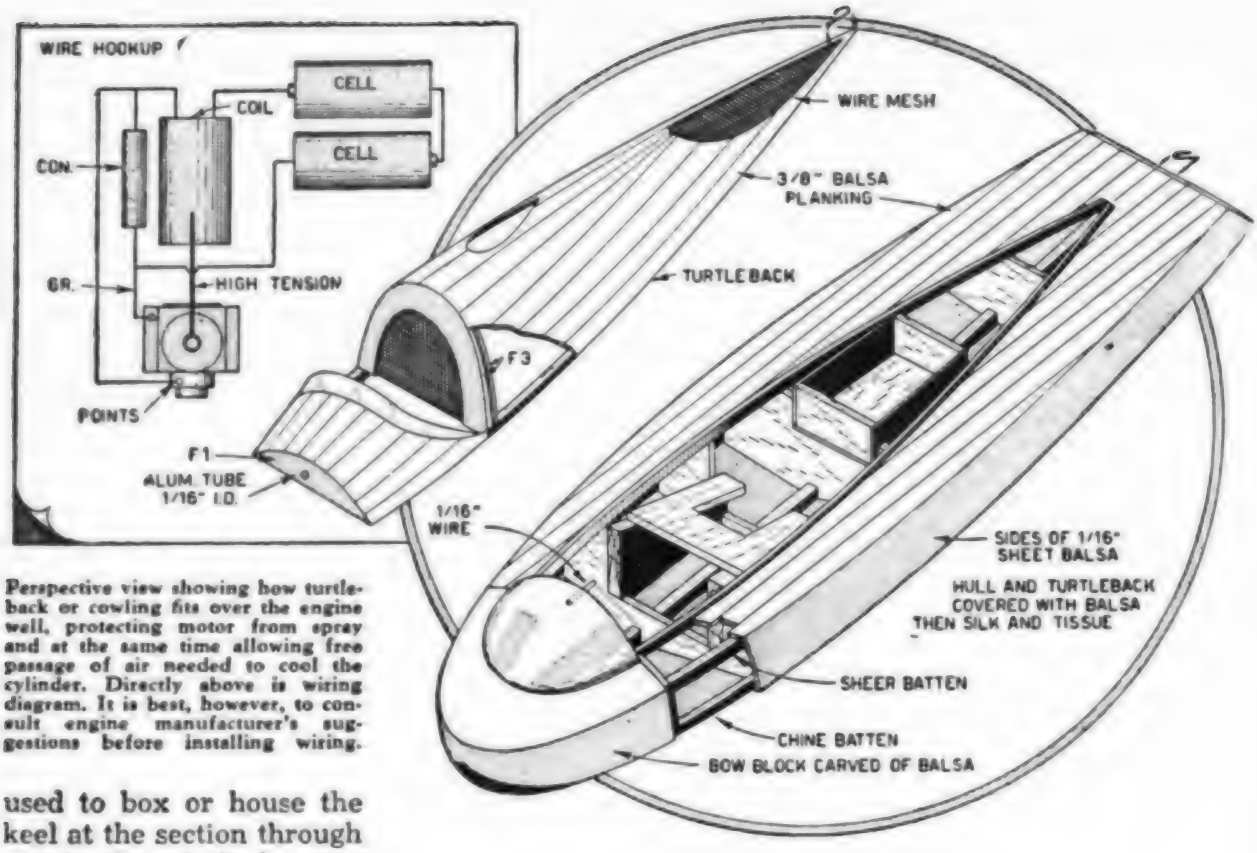
Referring to the diagram of the engine mount assembly, carve the mounts of ¼-in. pine. Cement them to bulkheads No. 2 and 3. Apply a liberal amount of cement and when it has hardened, fillet the units to the bulkheads with plastic wood. This will form a sturdy joint that will withstand the grind to which it is subjected by the engine.

Installation of the metal fittings is now advisable. These fittings may be either purchased or constructed by the modeler. At any rate, the installation is a simple operation if directions are followed.

Drill a hole through the keel and bulkhead No. 4 for the $\frac{5}{32}$-in. shaft housing. The angle at which the hole is drilled need not be accurate to the Nth degree, for if the hole is made slightly larger to allow play, the housing will assume the proper angle when hooked up with the other fittings. Note however that a thin brass plate is cemented and bolted to Bulkhead No. 4, and that $\frac{1}{16}$-in. plywood is



Keel must be cut to exact size and shape, after which the bulkheads are mounted on it in their proper places and cemented down. Fairness of the skeleton thus formed should be checked by running light strips of wood around the outsides.



Perspective view showing how turtleback or cowling fits over the engine well, protecting motor from spray and at the same time allowing free passage of air needed to cool the cylinder. Directly above is wiring diagram. It is best, however, to consult engine manufacturer's suggestions before installing wiring.

used to box or house the keel at the section through which the shaft housing and the strut go.

Assuming that the strut is to be constructed by the builder, the following procedure is used.

Streamline brass tubing 1¼-in. in length is used to make the strut. A bolt is driven into the top end of the strut and soldered into place. The lower end is filed to form an angle as indicated in the structural layout and a short length of ¼-in. outside diameter brass tubing is soldered to the strut. The inside diameter of this should of course be large enough to accommodate the ⅛-in. diameter propeller shaft. After the solder has cooled, one end of the strut bearing is reamed out to accommodate the fitting of the shaft housing. Before soldering the housing to the strut however, the latter unit is mounted to the hull as shown in the sketches, and the universal must be completed with the engine installed.

An engine bed is cut from ⅛-in. plywood and attached to the engine mounts with six ⅜-in. wood screws.

Holes are drilled in the bed to hold the engine bolts. These have not been indicated in the diagrams as they will vary with the types of engines to be used, and must be fitted on the job.

The universal shown in the plans is for a specific engine which features a spinner as an integral part of the motor. However, it may be easily adapted to any engine. Those wishing to get a ready made universal are advised to use one recommended by their engine manufacturer.

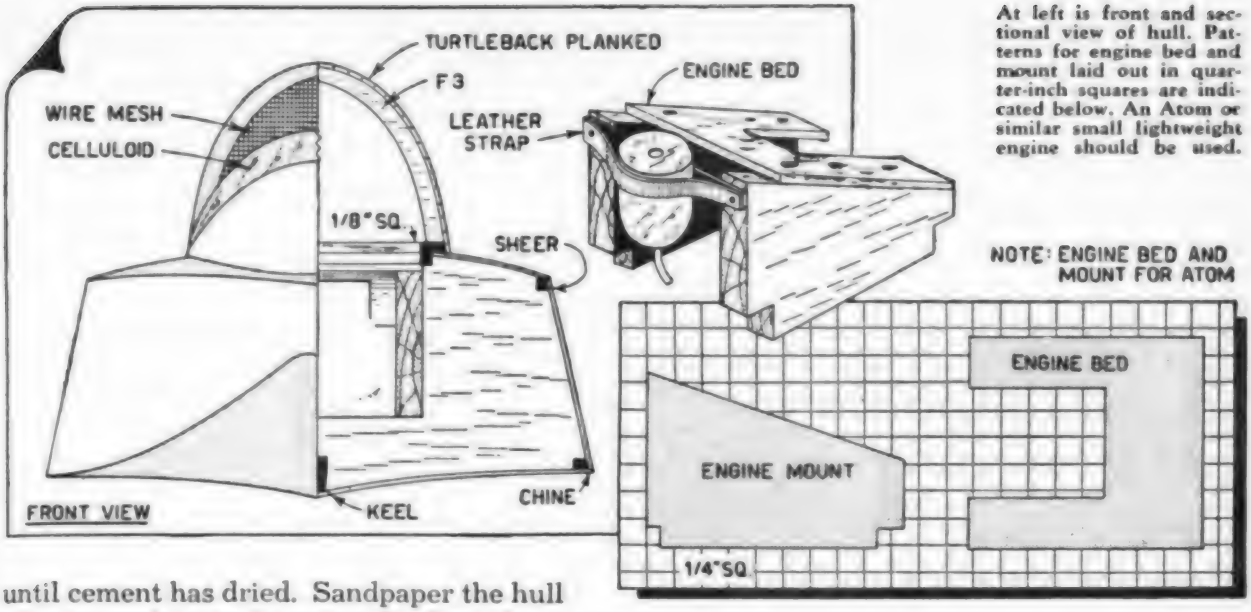
When the engine has been bolted to the mounts and the fittings assembled, solder the shaft housing to the strut bearing and to the brass plate bolted to bulkhead No. 4. Apply a liberal amount of plastic wood around the shaft housing and keel as well as at the keel and strut intersection.

Although the craft need not have a rudder if operated with a standard lariat assembly as used in racing, many builders wishing to operate the craft on a straight or controlled course, may add a rudder. Sketches of the metal fittings also indicate a simple method by which this unit may be built and attached.

After the fittings have been lined up remove the engine and coat the inside of the boat with several layers of spar varnish over wood filler. This operation is intended to waterproof the boat. When completed, the battery box, gas tank, and ignition system may be mounted to the hull.

Two ⅛x¼-in. balsa stringers are cemented to the top of the bulkheads and when dry the hull top is planked.

Strips of $\frac{1}{16}$x⅜-in. balsa are used in planking the deck. Pins hold the planks in place



At left is front and sectional view of hull. Patterns for engine bed and mount laid out in quarter-inch squares are indicated below. An Atom or similar small lightweight engine should be used.

until cement has dried. Sandpaper the hull when complete and coat with clear dope.

The bow of the boat is carved of a hard balsa block and cemented to bulkhead No. 1. Sandpaper the bow as indicated in the plans and apply several coats of clear dope.

Construction of the motor housing is our next step. Lay two base strips of ⅛-in. square balsa around the outside of the protruding end of the ⅛x¼-in. strips on the deck. Pin the base strips so that they follow the contour of the hull opening. Carve from $\frac{1}{16}$-in. sheet balsa the formers F1 to F5 and cement in their proper place on the base strips. A ⅛-in. square strip is cemented to the top of the formers. Note that there are two F3 formers and that between them is placed a strip of wire mesh.

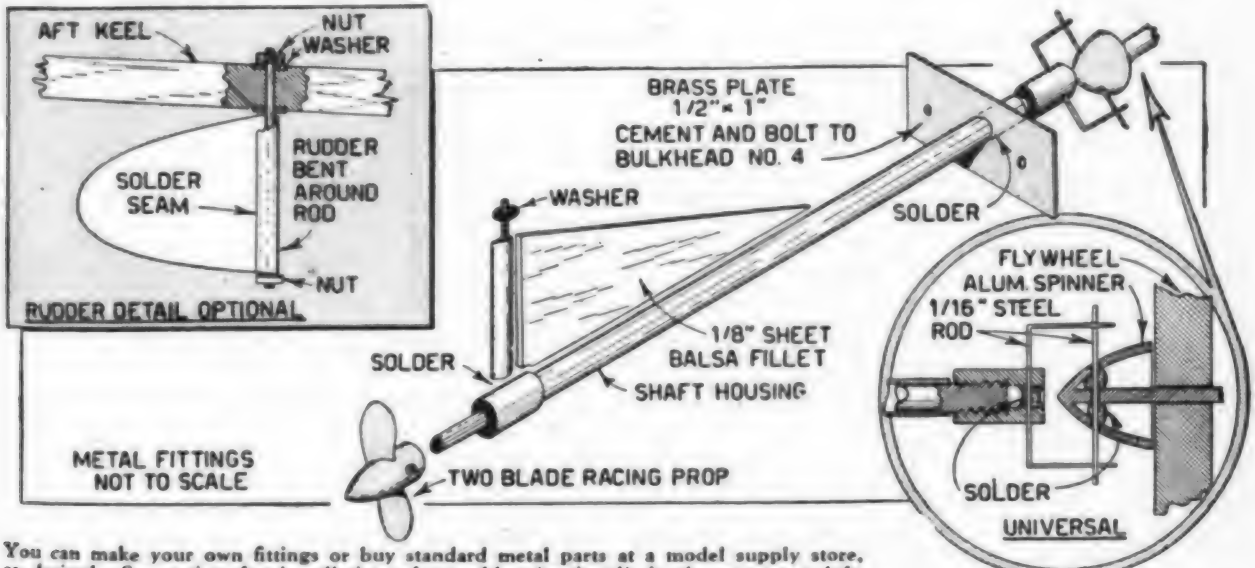
Plank the motor enclosure with sheet balsa of the size used for the deck planking. Start from the bottom of the housing and plank to the center stringer at the top of the formers. Use pins to hold the planking into position until the cement has dried.

Using a sharp razor cut away the portion of the enclosure at the top of the engine. Also shape the cockpit and the rear opening to which you cement wire mesh.

Sandpaper the enclosure and lift it off the hull. Make certain that all the cemented joints have hardened before lifting the top from the hull otherwise it will not maintain the double curvature it requires to fit on to the hull properly.

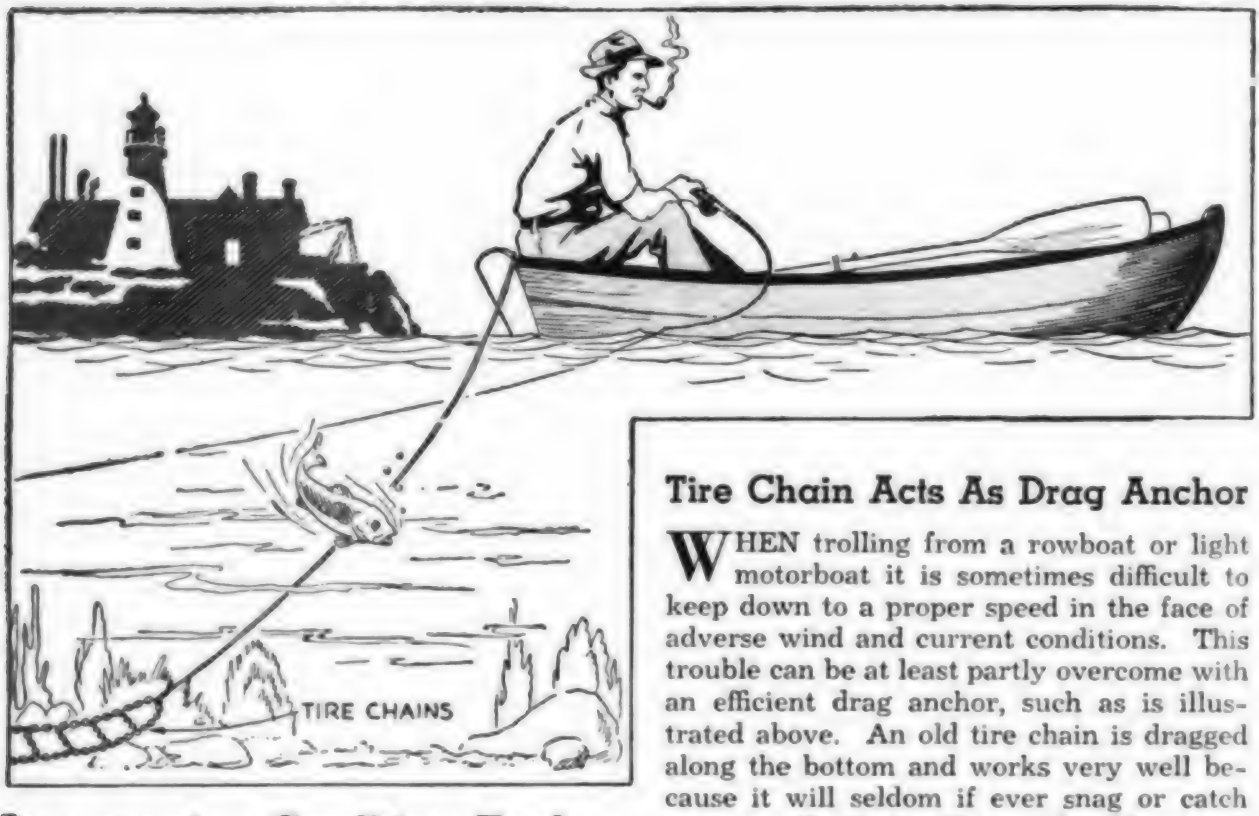
Both the enclosure and the hull is to be covered with Japanese silk and coated with several layers of clear dope. When the dope is dry, cover over with Jap tissue and again coat with dope. In this manner, a

[*Continued on page* 140]



You can make your own fittings or buy standard metal parts at a model supply store, as desired. Suggestion for installation of a rudder (optional) is shown at top left.

NAUTIKINKS FOR BOAT

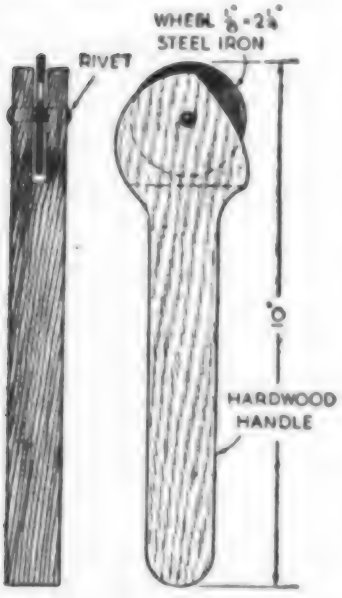


Tire Chain Acts As Drag Anchor

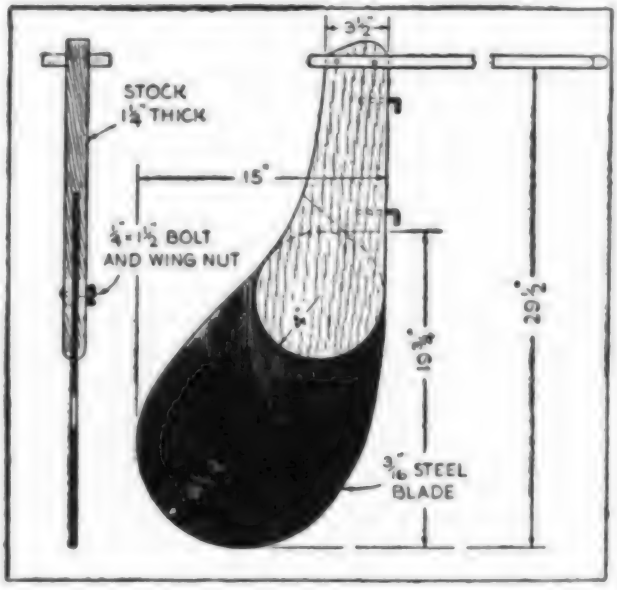
WHEN trolling from a rowboat or light motorboat it is sometimes difficult to keep down to a proper speed in the face of adverse wind and current conditions. This trouble can be at least partly overcome with an efficient drag anchor, such as is illustrated above. An old tire chain is dragged along the bottom and works very well because it will seldom if ever snag or catch permanently, but will considerably retard the boat's progress.—*G. E. H.*

Inexpensive Caulking Tool

CAULKING small boats with the ordinary caulking iron is a slow and laborious process, but with the easily made caulking wheel, below, the work will be speeded up considerably and result in a better job. Cut the handle from maple or other hardwood, to the approximate size and shape indicated. The iron wheel is centered in place on an ordinary rivet, so that it may revolve freely. Edge must be thin enough to fit in seams.



Novel Adjustable Rudder



MOST small sailboats have such deep rudders that it is impossible to sail into very shallow water without unshipping the rudders, or else risk the danger of breaking them on the bottom. The rudder above may be instantly adjusted to any desired depth, and will still retain most of its efficiency, thereby keeping the boat under absolute control.—*W. J.*

FANS

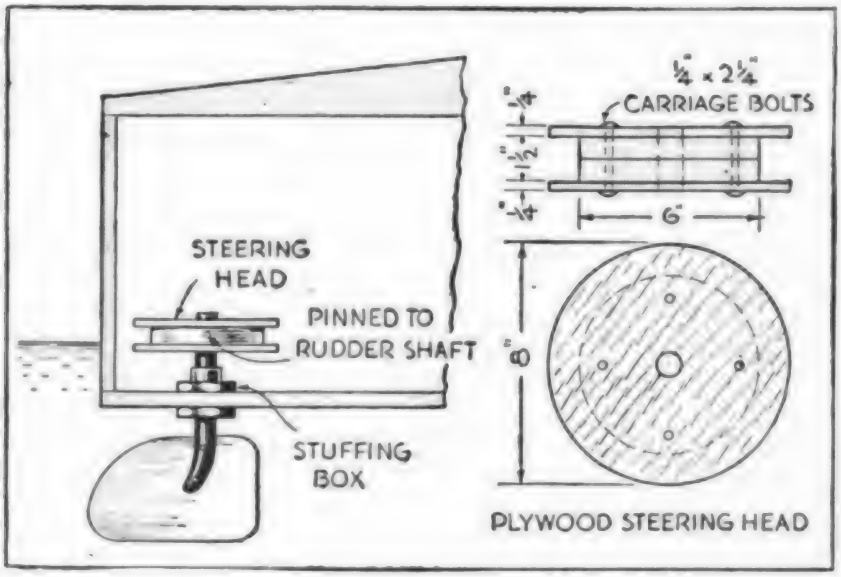
Glass Jar For Watch and Cigarettes

A GLASS jar with a wide mouth and a watertight screw cap is useful on small boats to protect a watch, cigarettes, matches, etc., from spray and dampness. The watch is suspended in the jar on adhesive tape in such position that its face is plainly visible, and the cigarettes are behind the watch. The arrangement is particularly handy when all members of a boating party are in bathing suits. If the jar is fastened to a small shelf, it can be mounted in any convenient place.—*B. B.*

● Lacing Will Repair Split Canoe Paddles

IF YOUR canoe paddle is split, you can prevent further breakage and add

[*Continued on page* 142]



Steering Head For Motor Boats

THIS easily made steering head attached to the rudder makes operation sure and even throughout the turning radius. The steering head is pinned to rudder shaft and tiller lines wound two or three times around head while center of line is secured to head with a wire staple.—*W. J.*

The "LF-5"

This attractive radio receiver tunes in the 200-400 kilocycle band and brings in the ground radio transmitters you can't hear with an ordinary short-wave set.

by Howard G. McEntee

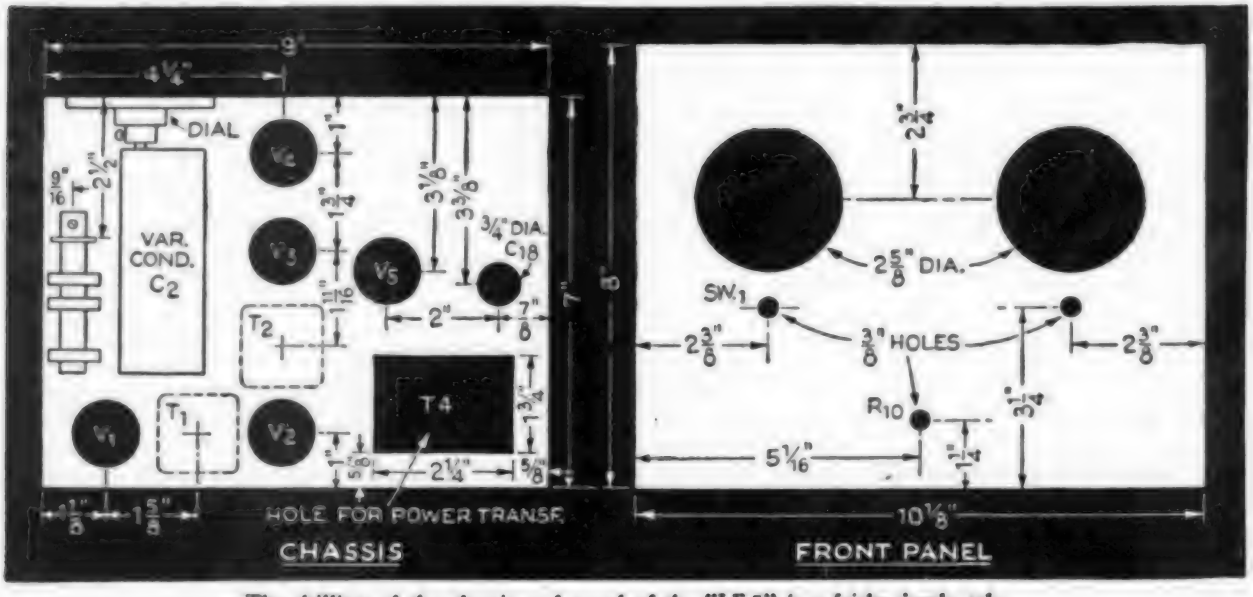
How the "LF-5" (top) is used with a regular short-wave receiver (in this case a Hallicrafter "Super-Skyrider," a popular amateur set) to reproduce both ends of ground-air radio conversations. A separate aerial should be used. This may be a single wire between 50 and 200 feet in length.

IF YOU own a short-wave or all-wave receiver you undoubtedly have spent many hours listening on the high frequencies to the ships of various airlines. But haven't you often felt baffled and disappointed because you couldn't hear the *ground* end of the conversations? You probably hunted all over the dial of your set, vainly searching for the airport stations. You didn't hear 'em, for the simple reason that the ground control stations operate in a low frequency band, far removed from the tuning range of standard radio receivers. This band is between 200 and 400 kilocycles. The "LF-5" receiver is the answer to this problem.

Put it next to your regular short-wave receiver and tune in *both* ends of those thrilling air-ground contacts! You'll get a new picture of modern day flying as you learn how pilots guide their way to safety.

All the parts required for the "LF-5" are of standard make and are easily obtained from any radio supply house. The actual tuning range is 150 to 420 kilocycles, thus giving comfortable overlap at both ends of the scale.

The superheterodyne circuit is quite straightforward, and the average hobbyist can build it and get good results. Practically



The drilling of the chassis and panel of the "LF-5" is a fairly simple job.

the only circuits the least bit out of the ordinary are to be found in the antenna and first detector input positions. Use is made of a so-called band pass tuning arrangement to gain extra selectivity. Thus there are three tuned circuits giving equivalent selectivity to a set employing an R.F. stage, though without the extra gain of the latter. The sensitivity is quite adequate, however.

In order to reduce interference from strong local stations around 455 kc. (the intermediate frequency), a wave trap, L1-C1, is included in the antenna circuit.

Construction is really quite simple and starts, of course, with the spotting of parts on the chassis. There is plenty of room, so the parts are simply placed as shown in the illustrations, the required holes marked and drilled. The power transformer T4 is mounted with core horizontal, and a hole about 1¾"x2¼" must be cut for the winding to pass through. This hole is made by drilling a series of half a dozen holes close together, and connecting them with a cold chisel. Then the piece may be quickly cut with a hacksaw.

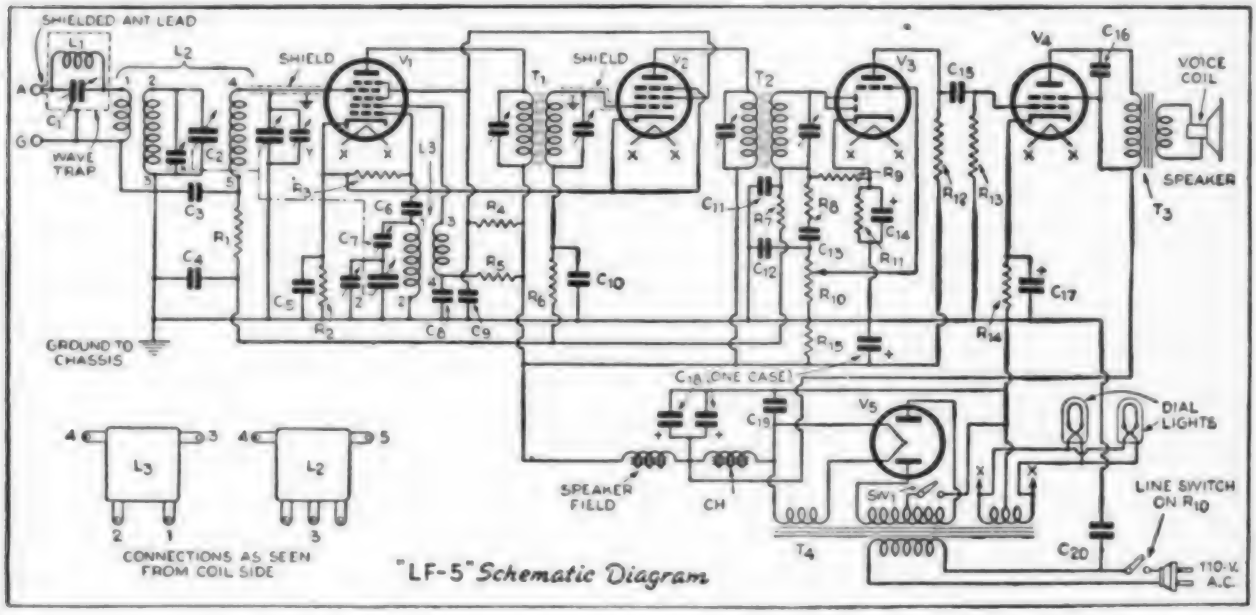
The three-gang variable condenser C2 is elevated 1¼" above the chassis on three threaded bushings. This part and the dial should be mounted first; make sure that the two are well aligned so that the dial does not bind or slip.

A great help in cutting out the five socket holes is a circular saw used in a drill press or an electric hand drill. The size marked "1" pipe" will provide the correct opening for metal tubes in wafer sockets as used here.

Holes are drilled on the chassis rear for the power cable and binding post strip.

The chassis must be fastened ½" above the lower edge of the front panel in order to clear the forward lip of the case bottom. The two are held together with four screws in the corners, and by the volume control (R10) fastening nut.

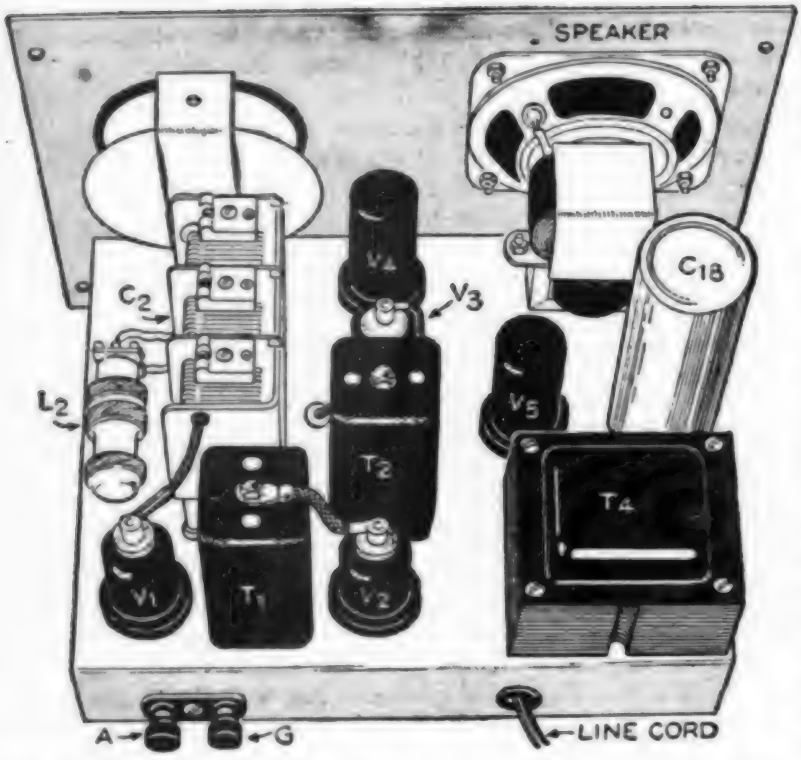
The two large holes in the panel are 2⅝" in diameter and are made with a fly-cutter. The left-hand hole has a piece of cloth glued over it on the back to conceal and protect the speaker cone. Both openings are finished off with metal plates, which in this particular receiver were painted flat black to contrast



"LF-5" Schematic Diagram

List OF Parts

R1, R6—200,000 ohm carbon ½ watt (I.R.C.)
R2—300 ohm carbon ½ watt (I.R.C.)
R3, R8—50,000 ohm carbon ½ watt (I.R.C.)
R4—30,000 ohm carbon 1 watt (I.R.C.)
R5—50,000 ohm carbon 1 watt (I.R.C.)
R7—2 meg ohm carbon ½ watt (I.R.C.)
R9—1 meg ohm carbon ½ watt (I.R.C.)
R10—.5 meg ohm variable resistor (I.R.C. No. 13-133), with built-in line switch
R11—5,000 ohm carbon ½ watt (I.R.C.)
R12—5 meg ohm carbon ½ watt (I.R.C.)
R13—.75 meg ohm carbon ½ watt (I.R.C.)
R14—400 ohm carbon 1 watt (I.R.C.)
R15—50,000 ohm carbon 2 watt (I.R.C.)
C1—(in wave trap)
C2—3-gang variable condenser (Meissner No. 21-5222) 365 mmf. per section
X-Y-Z—50 mmf. trimmers (Meissner No. 22-52 56)
C3, C10, C13, C20—.01 mf. paper 400 volt (Cornell-Dubilier No. DT4S1)
C4, C5—.1 mf. paper 400 volt (Cornell-Dubilier No. DT4D1)
C6—100 mmf. mica midget (Cornell-Dubilier No. SWST1)
C7—80-225 mmf. padder (Meissner No. 22-7028)
C8, C15—.02 mf. paper 600 volt (Cornell-Dubilier No. DT6S2)
C9—.1 mf. paper 600 volt (Cornell-Dubilier No. DT6P1)
C11, C12—500 mmf. mica (Cornell-Dubilier No. SWST5)
C14, C17—Double 10 mf. 25 volt electrolytic (Cornell-Dubilier No. BRL2101)
C16—.005 mf. mica (Cornell-Dubilier No. 1WSD5)
C18—Triple 8 mf. electrolytic (Cornell-Dubilier No. KRL5888)
C19—.02 mf. 1,200 volt paper (Cornell-Dubilier No. MD12S2)
L1—Wave trap (Meissner No. 15-7518)
L2—Band pass inductance (Miller 7468-ABP)
L3—Oscillator inductance (Miller 7468C)
T1—455 kc. I.F. transformer (Meissner 16-5740)
T2—455 kc. output IFT (Meissner 16-5742)
T3—Output matching transformer (Oxford 21J78)
T4—Power transformer (Thordarson T13R12)
CH—Filter choke (Thordarson T13C28)
Speaker—3½" size, 450 ohm field (Oxford 3W1)
Switch on R10 (IRC No. 21)
SW1—Switch SPST rotary type
V1—6A8 tube (RCA)
V2—6K7 tube (RCA)
V3—6Q7 tube (RCA)
V4—6V6 tube (RCA)
V5—5Z4 tube (RCA)
Dial (Crowe No. 180)
Knobs (Crowe B146)
Case (Par-Metal CA201)
Chassis 7"x9"x2" (Par-Metal C4511)
5—Octal wafer sockets
Power line cord with plug
Binding post strip



This back view of the "LF-5" shows the neat arrangement of the parts, which are marked to correspond with the schematic diagram on page 93.

with the gray case and bright red knobs, a very pleasing combination.

The loud-speaker fastens directly to the front panel with four screws, and comes with a bracket on which the output transformer, T3, is held.

The wiring is started by connecting all a.c. leads, including heater circuits. Follow with the power supply connections, then go right through the circuit from one end or the other. All condensers and resistors are secured firmly at both ends, employing unused socket pins and one long terminal strip.

It will be seen that a three-section electrolytic condenser, C18, is used with two of the sections in parallel. The only condenser at the input to the filter system is C19, a .02 mf., 1,200 volt paper unit. Do not connect a section of C18 at this point as the voltage to the receiver will be raised to an unnecessarily high level. The hum level in the receiver is very low with the filter circuit as shown.

The loud-speaker is equipped with a so-called hum-bucking coil. To make this effective in removing hum, try interchanging the leads from the field coil to see which way gives the lowest level. Do this with the volume control all the way off. A calibrated oscillator is of great help in getting the outfit quickly tuned up. Set it at 455 kc. first, feed the output to the grid cap of V1, and adjust the four I.F. transformer trimmer screws for highest output. Next, set the receiver tuning condenser at minimum capacity and align the three trimmers on the latter at 420 kc. Then rotate the variable to maximum and adjust the padding condenser until the background noise is highest. This should be around 150 kc.

The final step is setting of the wave trap condenser, C1. Connect the receiver to aerial and ground, adjust the dial to the high frequency end of the band (plates all out) and couple the service oscillator set at 455 kc. *loosely* to the antenna lead. Simply adjust C1 until the signal from the oscillator is *minimum*. This adjustment will not require resetting thereafter. This part of the job is best done by the local radio service man, who uses an oscillator in his daily work of lining up superheterodyne receivers. He'll probably charge a dollar or so for the operation and it will be well worth it.

As a final check it may be said that the high voltage at terminal 4 of V4 should be about 250 volts; at terminal 3 of V1 and V2, about 250 volts; and at terminals 4 and 6 of V1, about 100 volts. These values may vary 15% or so either way without affecting operation noticeably, and are given as average values only.

The switch SW1, which is mounted under

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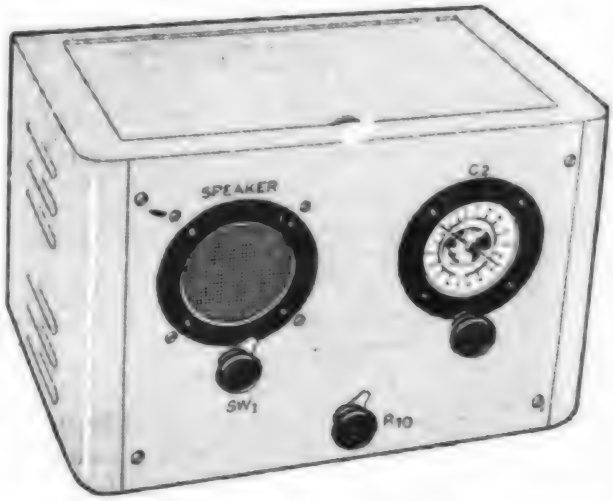
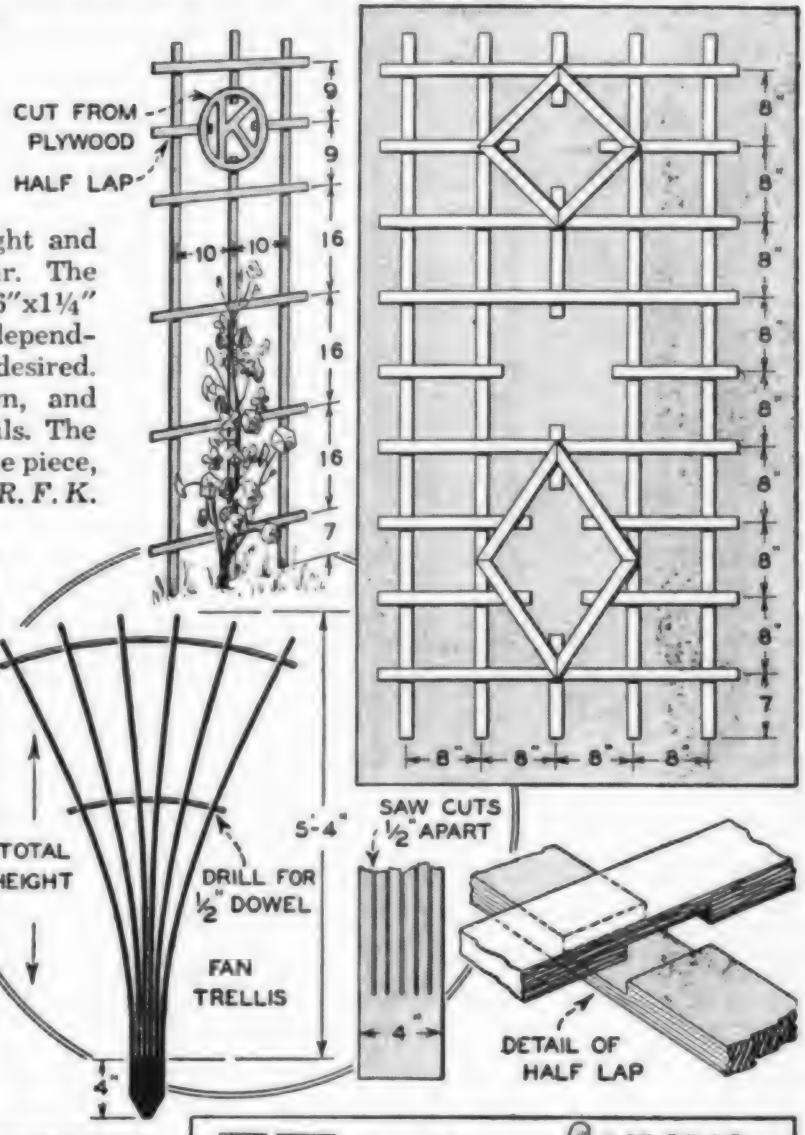


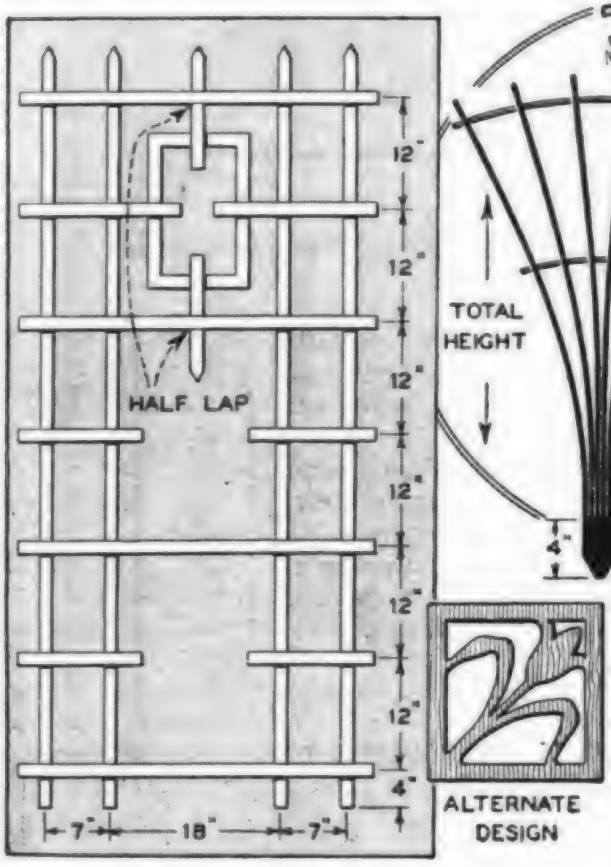
The utter simplicity of the "LF-5" is what makes it attractive.

FOR GARDENERS' WORKSHOPS

Trellis For The Lawn

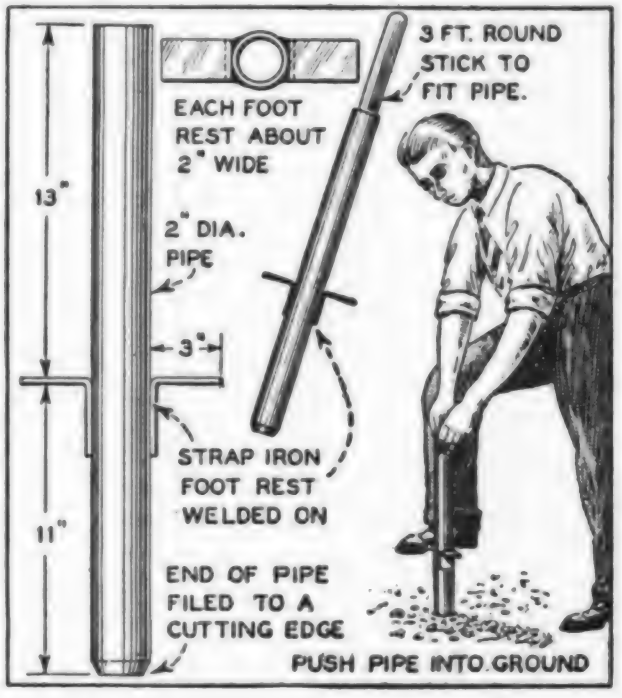
A TRELLIS is not only a decorative thing but also an object of definite utility in promoting the development of many kinds of plants. The types of trellis shown at the right and below are among the most popular. The framework can be made from 5/16"x1¼" lattice or ¾"x1¼" shingle laths, depending on the size and strength desired. Joints are overlapped as shown, and fastened with two galvanized nails. The fan shaped trellis is sawed from one piece, sprung to the position indicated.—*R. F. K.*



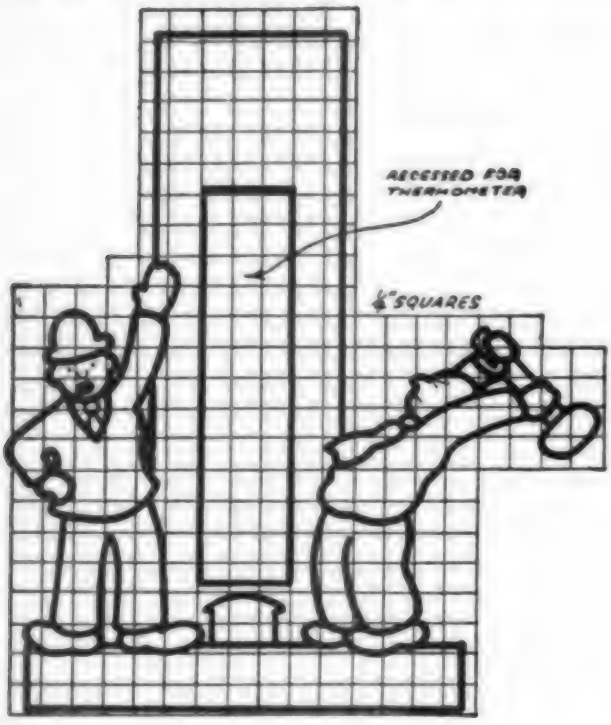


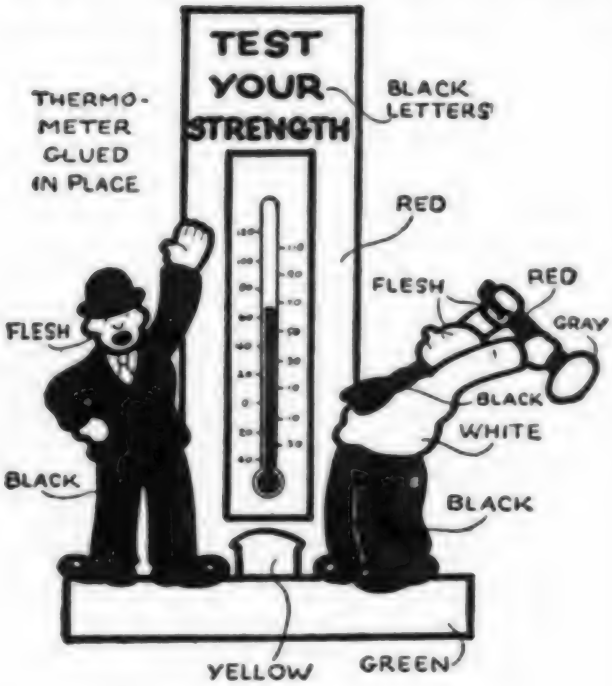
A Simple Bulb Planter

WHEN a large number of bulbs are to be set out the device at the right will prove very helpful. It is simply a 2' length of pipe with one end filed or ground to a sharp edge. It is pushed into the ground with the foot rests to make a hole in which the bulb is placed. The earth contained in the pipe is replaced in the hole on top of the bulb by pushing the stick through the pipe.—*S. O.*



WOODWORKING PROJECTS





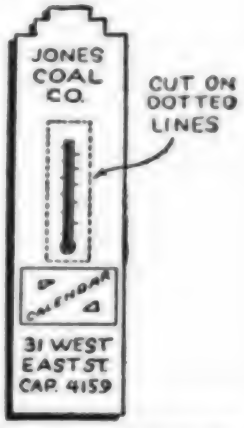
THE COMPLETED NOVELTY.

Novel Thermometer

A CARDBOARD calendar-thermometer of the type shown is usually discarded as soon as the calendar has expired. With a minimum of effort, however, the thermometer may be converted into a colorful and permanently useful article.

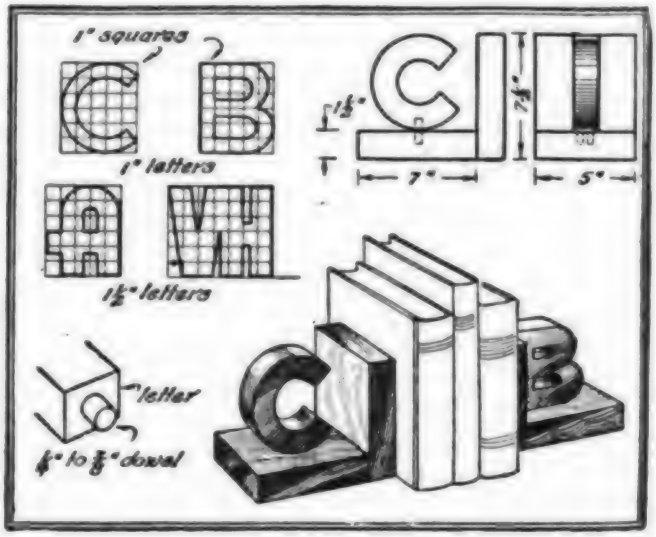
As illustrated, the segment of cardboard containing the thermometer is cut out and mounted on a jig-sawed backpiece representing a "test-your-strength" booth at a carnival or fair.

Enlarge the pattern for the backpiece to the required size by means of the squares. Transfer to ¼" plywood or other thin material and jig-saw to shape. The size of the recessed opening will be governed, of course, by the size of the thermometer to be mounted in it.—*C. S.*



Initial Book-Ends

DRESS up your den table or desk with a set of these book-ends. Use only maple, figured gumwood or walnut. Use stock which will dress down to a thickness of 1½" for base and block letters. The squared diagrams show the relative appearance of letters cut out 1" and 1½" in cross-section. The 1½" thickness will give both types of letters a modern appearance. Letters may be joined. Single letters should be cut from blocks 5" wide and 6" high. Mark them carefully, and saw them out on the jig saw. The base is 7" long and the vertical piece 7½" long, both being finished 5" wide. Assemble with ⅜" dowels.—*G. E. V. H.*

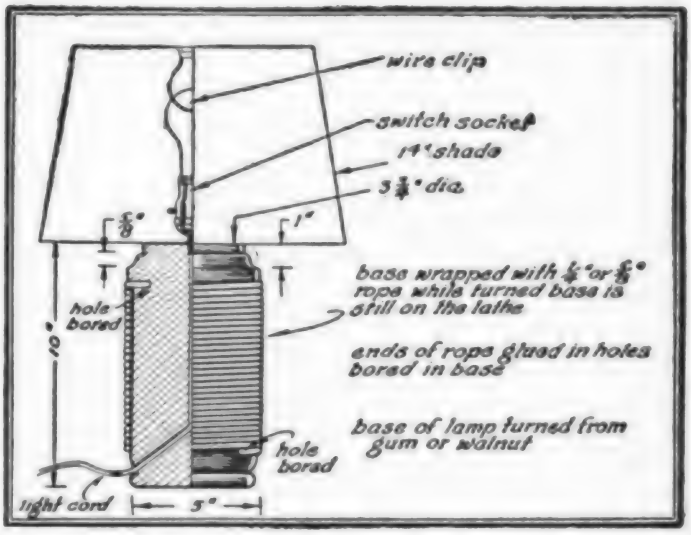


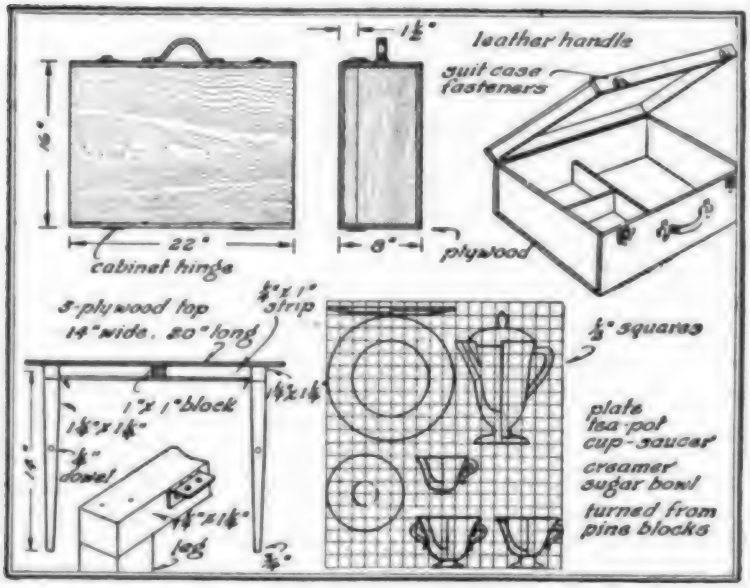
FOR THE HOME MAKER

Nautical Lamp

THE wooden base of this nautical lamp is bound in quarter-inch rope. Turn down the base from a glued-up block of gumwood or walnut about 5½" in diameter and 10" high. A bead is turned around the top and bottom of the lamp, the one at the top being 3¾" in diameter and the one at the bottom 5". A shoulder is formed 1" below the top, which curves upward and in to meet the lower edge of the bead at the top. A bed or slight depression is turned from a point slightly below the

[*Continued on page 142*]





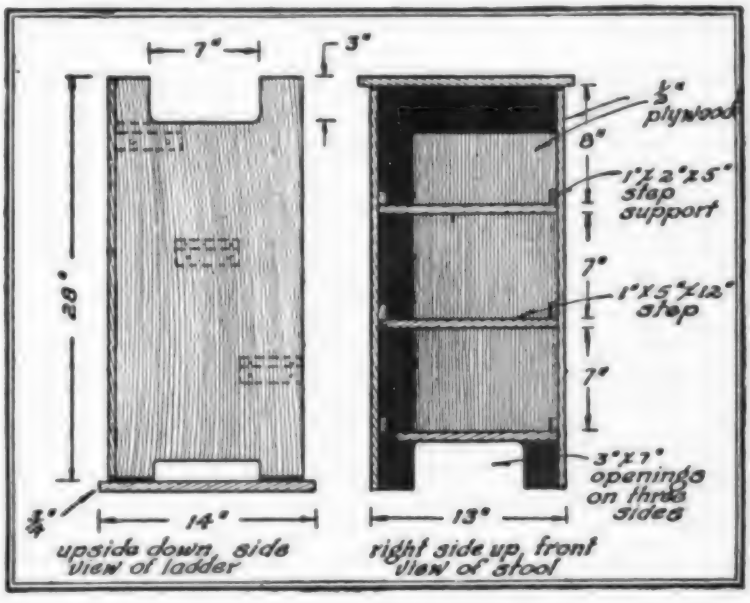
Toy Tea Set

A PANEL of quarter-inch plywood, three-by-five feet in size, will furnish enough material for the carrying case and table top, while scraps of soft pine can be used in turning the wooden dish set and making the other parts of the table. Finish the table top 14" wide and 20" long. Glue a 1"x1" block, 10" long, to the center of the table top on the underside, and to this block attach a plywood strip 1" wide and 15" long, lengthwise, which locks against the leg cross-

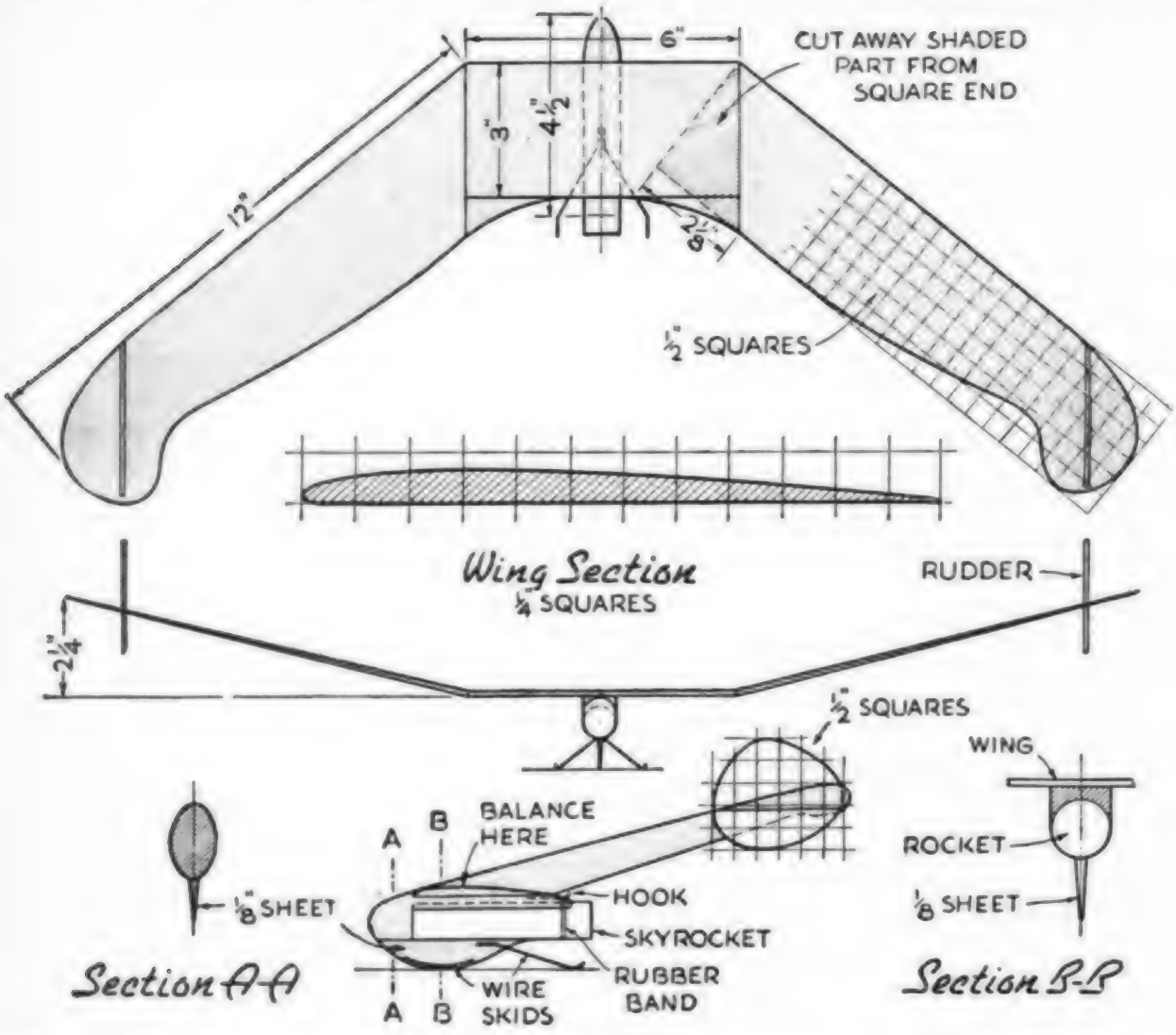
[*Continued on page 142*]

A Stool Ladder

THIS handy kitchen stool can be used as a comfortable seat while washing dishes or preparing meals, or it can be turned upside down and used as a ladder to reach upper shelves in the cupboard. Wide pine boards, or sections cut from plywood are used to form the three sides of the combination stool and ladder, the material used being ½" thick. The completed stool should be about 13" square at the bottom, with a seat or top ¾" thick and 14" square nailed in place. The three steps fit between the sides.



A Rocket Powered Model Plane



HERE is the model plane of the future. Hurled through the air in true Jules Verne fashion, by a rocket housed in its fuselage, this little ship provides a spectacle of performance and design that is hard to achieve with any other type of power.

The design is simple and rugged, and is based entirely on the requirements of rocket propulsion. The exhaust of the rocket makes a tailless plan absolutely necessary in order to avoid heat damage to the control surfaces.

The wing is of solid balsa construction ⅛" thick tapered to $\frac{1}{32}$" at the tips. A piece of the same sheet used in making the wing can be used for the skid fairing under the fuselage. The rudders are $\frac{1}{32}$" thick and of solid construction like the wing. The fuselage is carved to shape from a block of balsa 1"x¾"x4½" with the under side concave to fit the rocket tube.

The plans must be followed carefully as the stability of a tailless airplane is dependent chiefly on the design and balance of the wing. The balance point, or center of gravity of this particular model should be at a point 1½" back from the leading edge of the center section of the wing. If the finished model does not balance at that point, the rocket may be shifted back or forward until it does. Provision should then be made to hold the rocket in the correct position.

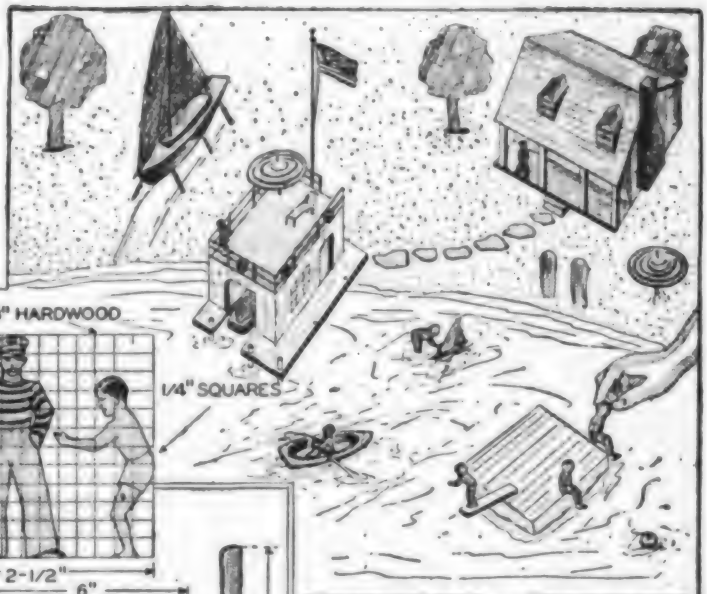
An ordinary 2 oz. skyrocket of the 4th of July variety is used, with the conical paper point removed as well as the stick. It is held firmly in place with a rubber band.

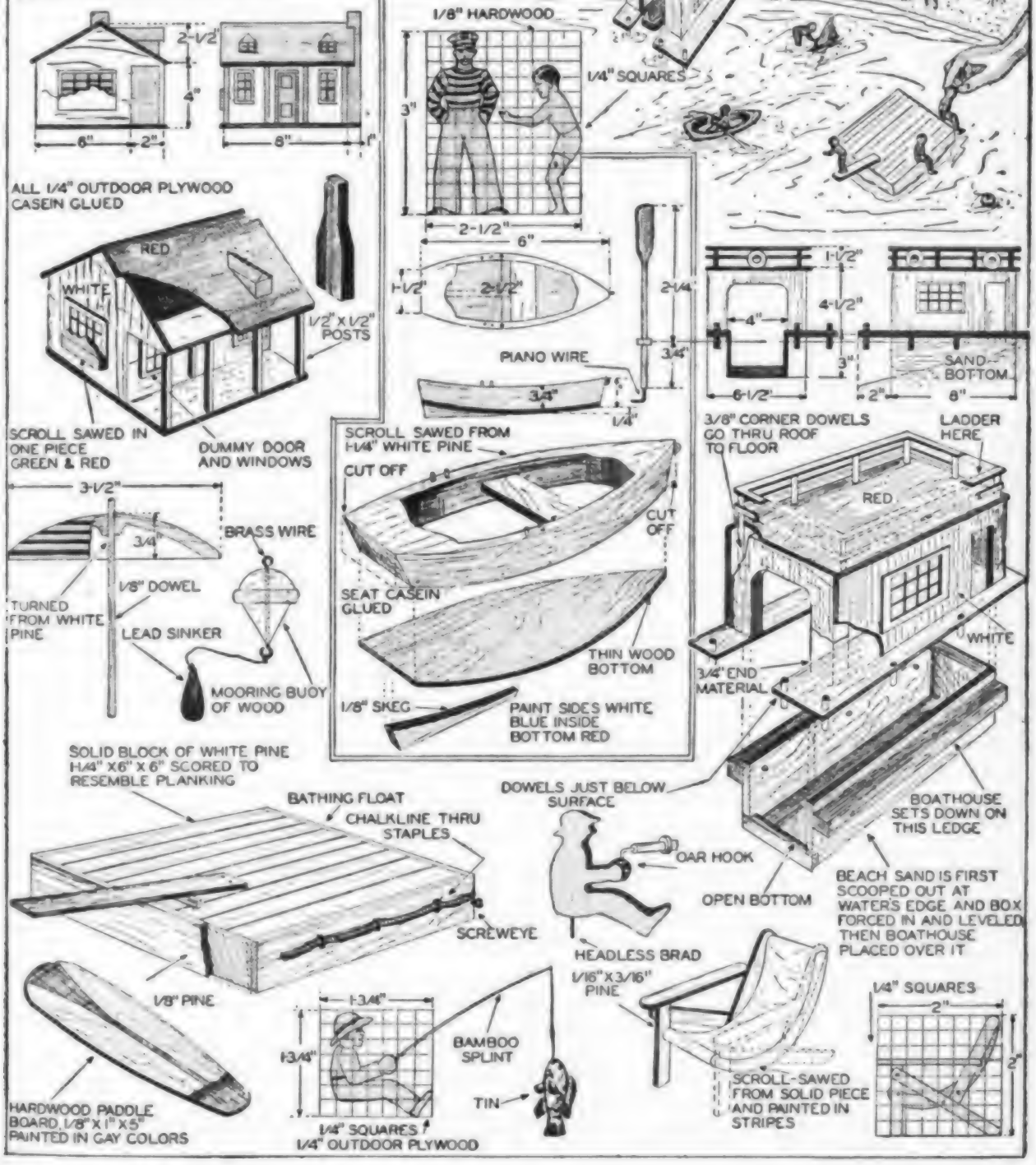
The wing tip tabs are warped up like elevators for flying trim. To fly, place the model in a shallow wooden trough slanted up at a 45° angle, then light the fuse. Do not attempt to hand-launch.—*Ralph Baker, Jr.*

Toy Estate For The Beach

by Hi Sibley

THE builder will have as much fun making this set as the child will playing with it. Every piece is surprisingly simple in construction, and painted in bright colors is exceptionally attractive at the waterside. Outdoor plywood is used for cottage and boathouse. Note that the latter is not only ruggedly built, but is made in two units so that the house itself will not need to suffer rough treatment in pushing down in the sand. Instead, the basin or box, is first located, and then the house fitted over it. Rowboats, beach umbrellas, chairs, surfboards and a complete bathing float add to the interest of this toy. Additional figures in various postures adapted to swimming, reading, sunbathing, etc., can be drawn to the same scale. Assembly of all pieces is with casein glue and brads.





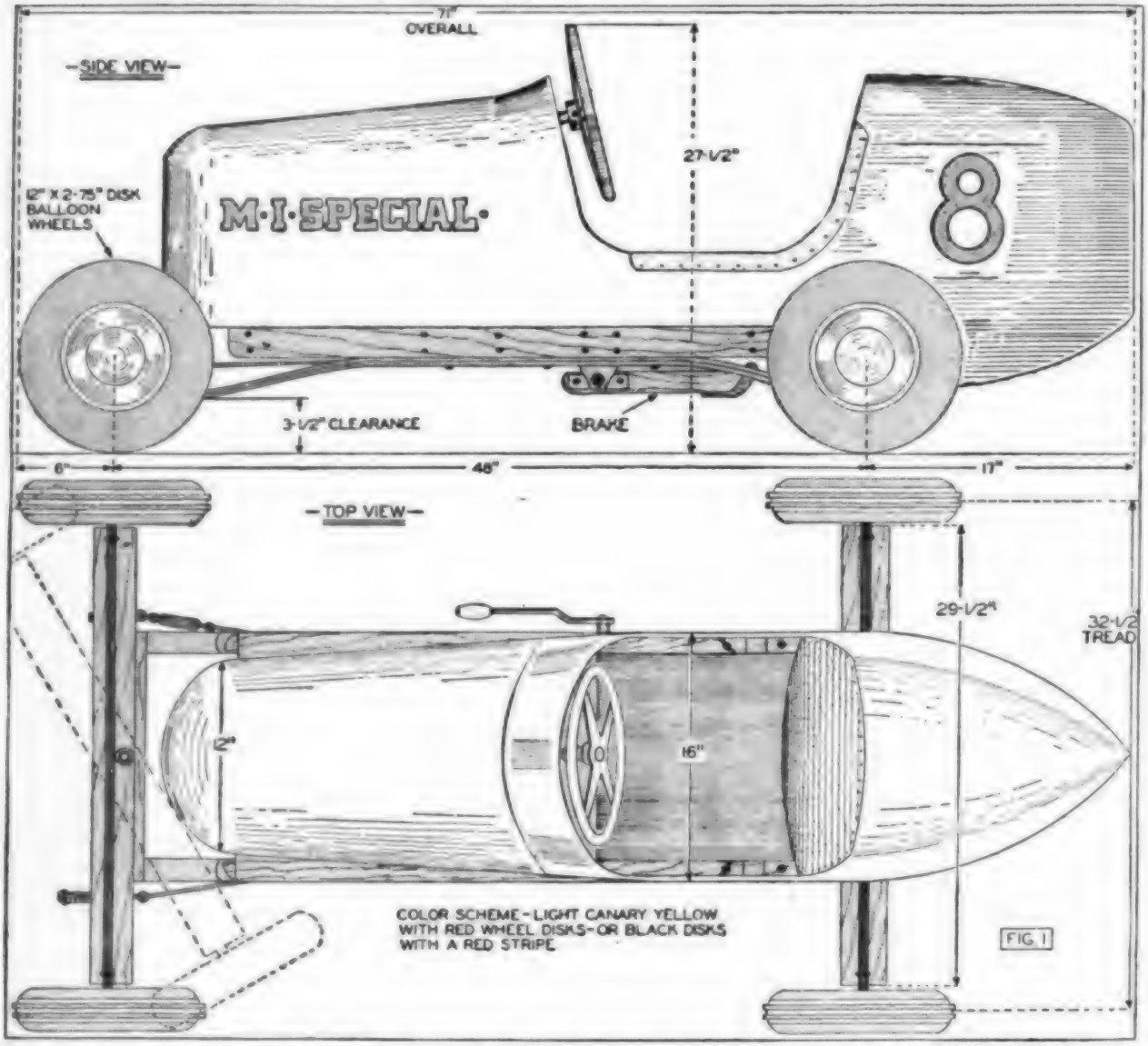
THE MI SPECIAL

by Hi Sibley

Here's an up-to-date "free wheeling" racer that you'll be proud to own and can easily build. If 12-inch solid rubber tired wheels are used the car will be eligible for entrance in the Soap Box Derby.

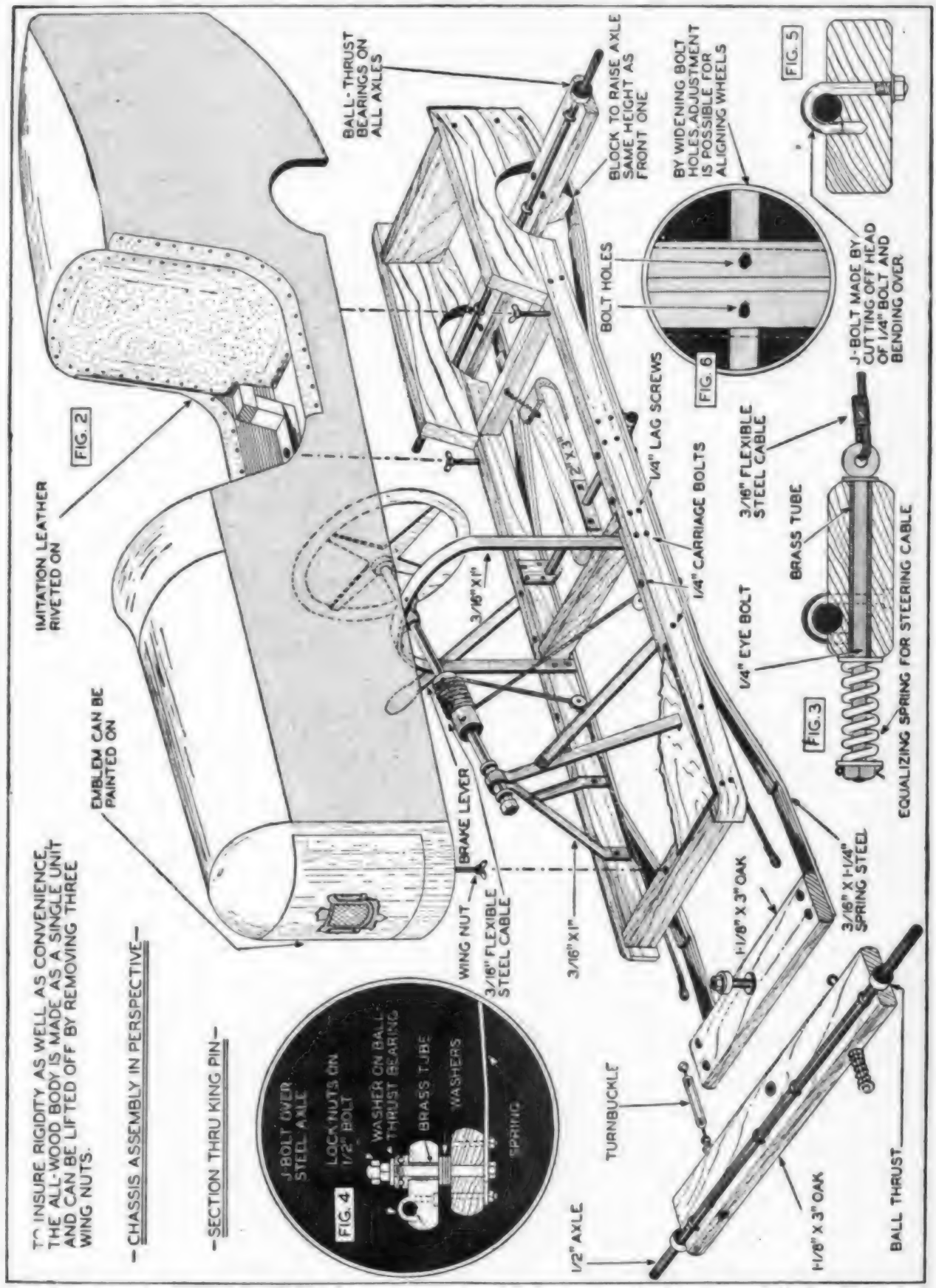
THIS compact little job, designed along the lines of the famous Indianapolis Speedway racers, is of exceptionally simple construction for a vehicle having spring suspension, an effective brake and a slack-proof steering system. Although wind-resistance is not a factor of first importance in soap box racing, this type of body gives rigidity to the entire chassis without affecting independent springing of the wheels. Being made as a single unit, it can be lifted off after removing only three wing nuts.

Spring suspension has been proved a big item in achieving a fast and smooth-rolling racer, and by the use of flat springs the complications of the coil-spring systems are avoided; at the same time once the wheels are properly aligned they will remain so. This is a distinct advantage, because wheels even slightly askew—a fraction

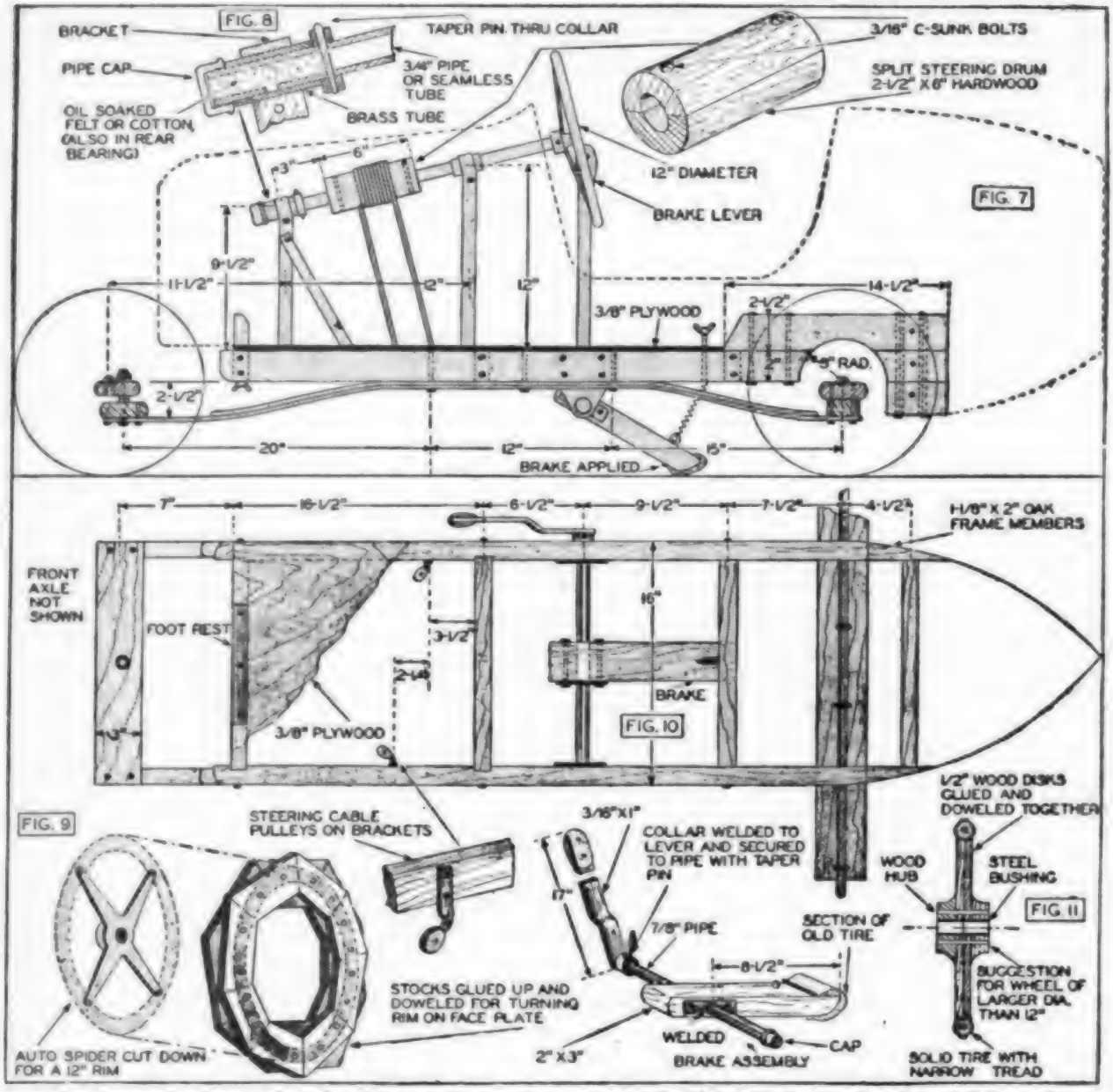


Realistic appearance of the car shows in general dimension drawing above. Twelve-inch balloon wheels or narrow tread solid tires may be used. The latter are required by the All-American Soap Box Derby rules.

SOAPBOX RACER



Body fits neatly over chassis and is held in place by three bolts and wing nuts, making it easily removable for repairs.



Steering mechanism consists of a drum on the steering post, around which cable is wound and carried forward to the front axle as shown. Front wheels turn in same direction as steering wheel.

of an inch—will cause a losing drag.

In Fig. 1 are given the general over-all dimensions. These, of course, can be adapted to individual needs. Twelve-inch disk balloon wheels are shown here, though the coaster-type of disk wheel required by Soap Box Derby rules is sometimes faster, especially if it has a narrow tread on the solid rubber. Since the MI Special is spring-suspended, solid tires can be used successfully.

Chassis assembly is given in perspective in Fig. 2, with steering gear and brake. Note that the flexible-steel steering cables are crossed under the drum, carried through pulleys to the front axle. A turn-buckle is inserted in the line on one side, and on the other an equalizing spring, keeping the cable always taut so that there is no hazard of the cables bunching on the drum. Also, one lead pulley is set forward of the other, another point in keeping the cable where it should feed on or off the drum. The equalizing spring is shown in section in Fig. 3, and it should be a stiff compression spring.

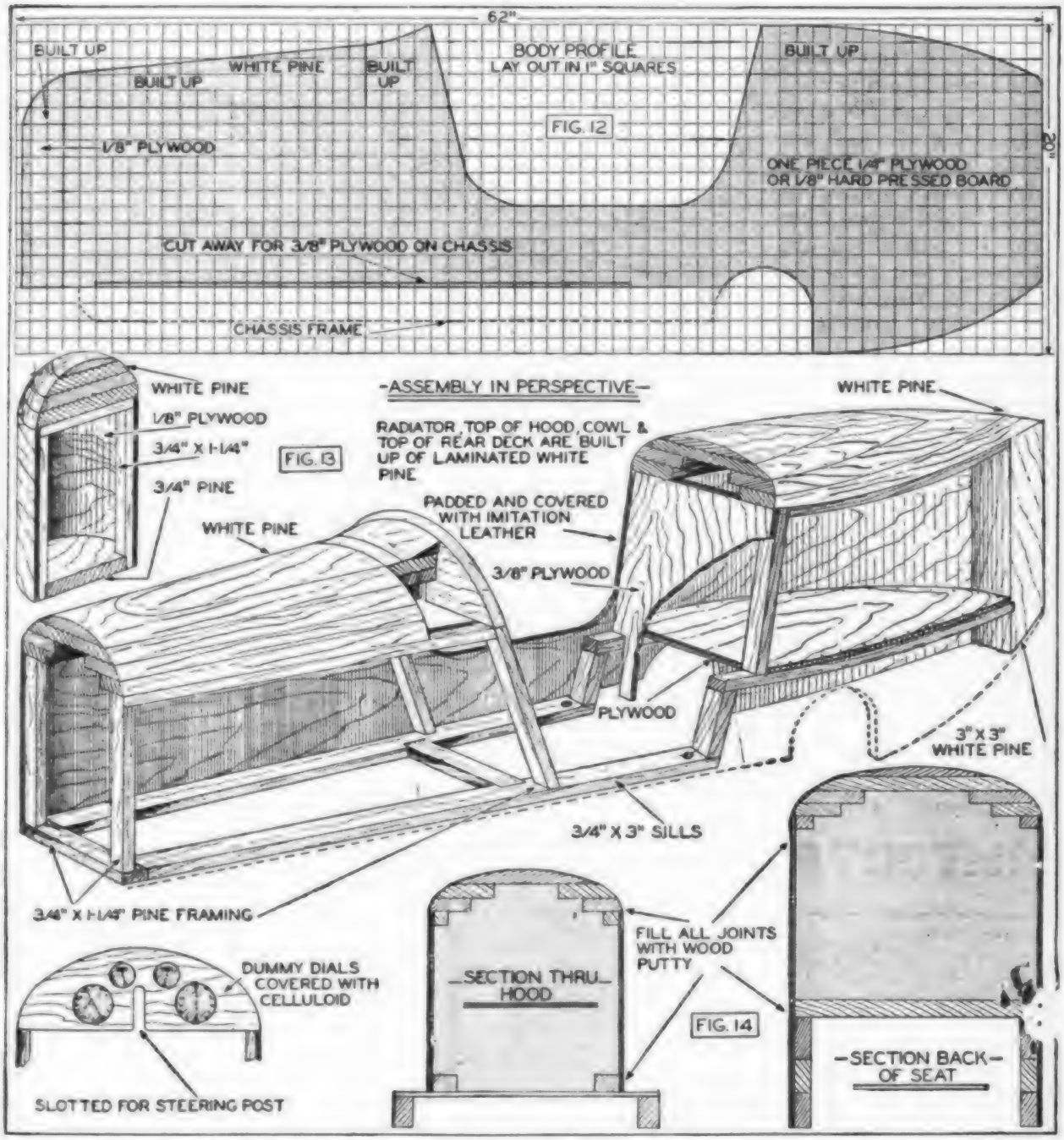
Assembling of the king-pin is illustrated in Fig. 4. Note that the weight is carried on a ball-thrust bearing, and wear is eliminated by inserting a brass bushing in the oak member. This can be a section of brass tube of the required diameter. The oak axle members are grooved to receive the steel axle, which in turn is clamped in place by four "J-bolts." These are merely carriage bolts with the heads cut off and ends bent over

after heating, Fig. 5. In case some adjustment is required in aligning back wheels with the front ones, the bolt holes in the wooden beam, Fig. 6, could be widened very slightly. Bear in mind that wheels on each side should be in parallel planes; i.e., when running in a straight course the rear wheels should follow exactly in the tracks of the front ones.

Dimensions of chassis and locations of various assemblies are given in Fig. 7. An easy working and taut steering gear is made as illustrated here, and is independent of the body. The two bearings for the steering post are self-oiling, as shown in Fig. 8. The steering-cable drum is made in halves and secured with small bolts, heads and nuts countersunk. This makes for easy assembly. Springs are of spring steel, $\frac{3}{16}$"x1¼" section, bent in the shape illustrated. The rear springs are shorter than the front, and should, with pilot aboard, spring equally with the front. To achieve this it may be necessary to add a third leaf in back, or to shorten the secondary leaf in front.

The average diameter of the standard automobile steering wheel, 18-in. and up, is rather too large for this coaster, and a special

[*Continued on page* 142]

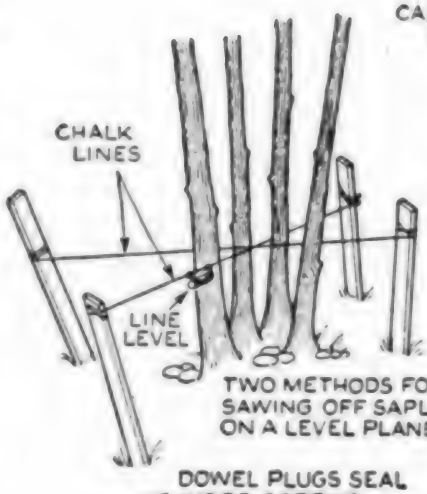


Body framing is built up of scrap lumber or cheap pine. Sides are plywood covered, and it is best to use Super-Harbord or other outdoor plywood for a lasting, weatherproof job.

TREE STUMPS
Make Ideal Garden Seats

by J. Modroch

BEFORE you remove a cluster of saplings because the trees border too closely on your flower beds, consider the advisability of converting the stumps into a garden seat. This can be done readily by cutting off the trunks at bench-height and mounting a suitably shaped board across their tops. In case there are not enough stumps in the cluster to support the seat firmly, additional legs, cut from tree branches, can be driven into the ground where needed. Circular-shaped seats go well with modern architecture, while at the shaded turn of an informal path an odd-shaped seat fits naturally into the setting. By letting the rearmost sapling of a cluster remain standing, a backrest is provided.



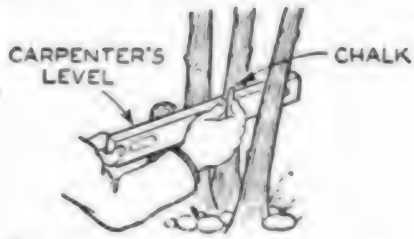
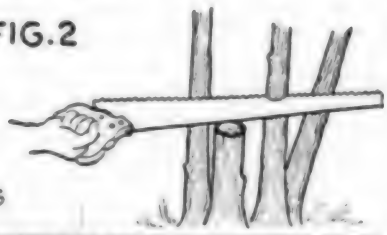


FIG. 2



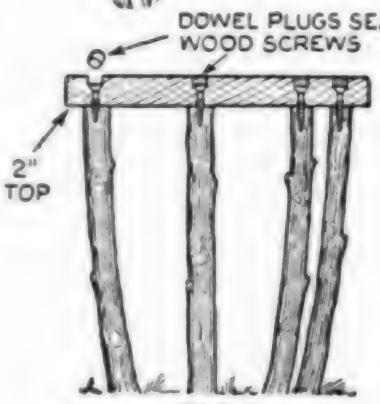
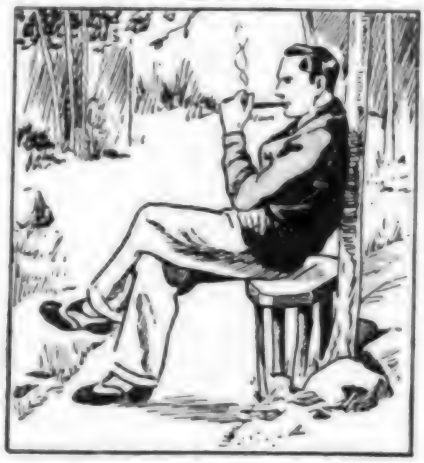
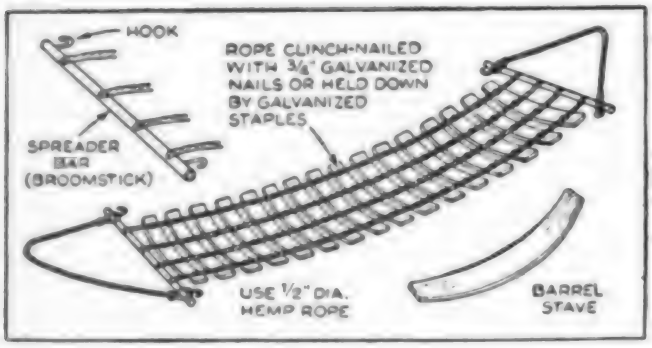


FIG. 1



For the sake of comfort as well as appearance, tree-seats should set level. Either of two methods, as will be noted in Fig. 2, can be employed for sawing off a cluster of saplings on a level plane. One employs a pair of crossed chalk lines strung tautly through the cluster and made true with the aid of a line-level. The other calls for cutting one stump to height first, and then chalk-marking the others on a plane with it. Long wood screws, countersunk and sealed with dowel-plugs, are used for fastening.

COMFORTABLE BARREL-STAVE HAMMOCK



AN EXCELLENT hammock can be made from ordinary barrel staves, some rope and two broom handles, as shown in the drawing. Galvanized nails or staples can be used to secure the rope to the staves. The ends of the rope are fastened to the spreader bars and an additional length of rope is used to fasten the hammock itself. Padding can be made to fit the hammock if desired. The staves can be painted a bright color.—*R. F. K.*

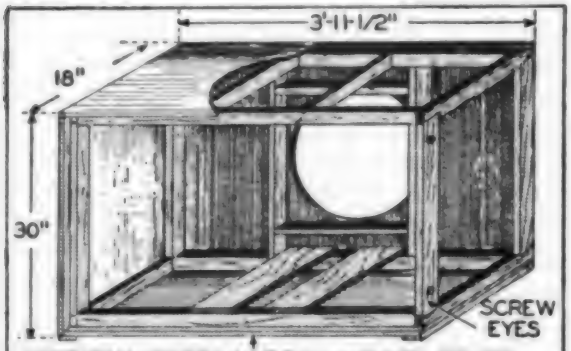
Low-Cost AIR CONDITIONER

THE principle on which this "poor man's air conditioner" is based is identical to that employed in standard outfits. Briefly stated, the method is to expose a large water surface for evaporation into a stream of air that is drawn into the house by a low-speed electric fan. At various southwestern state universities instructions and designs for making these simple cooling devices have been carefully worked out by the engineers and, using these, in recent years literally thousands of farmers and urban dwellers have been building their own outfits.

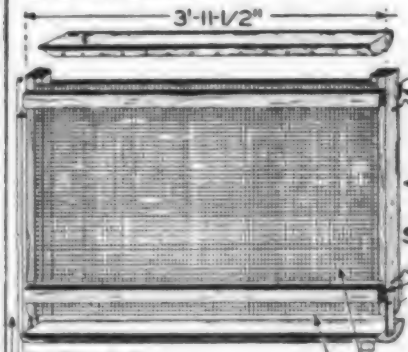
Over a window on the shady side of the house is constructed a box-like housing of wood or metal. Covering the outer end and sides of the box is a pad of loosely-packed wood excelsior, two or three inches thick, held in place between screens of wire or loosely woven fabric. Inside and opposite the pad a fan is installed with a fractional horsepower motor, operating at 110 volts.

Some form of a water trickler is placed at the top of the pad, fed by a copper tube with a controlling petcock from a pressure water system. Only enough water seeps through the pad to keep it moist but not wet. About 5½ gallons

[*Continued on page* 144]



PICTORIAL SKETCH OF BOX - PANEL BOARD REMOVED FROM ONE END AND PART OF TOP TO SHOW FRAMING



LENGTH OF INSIDE TOP AND BOTTOM RAILS 1/8" LESS THAN INSIDE WIDTH OF BOX

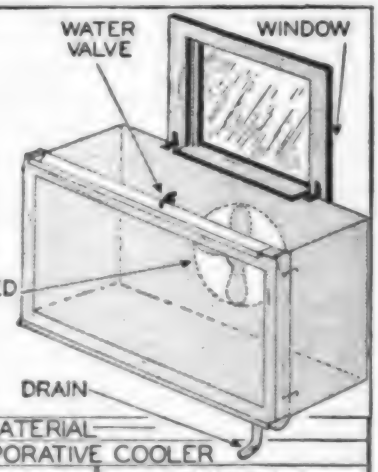
VERTICAL SPACING 1/8" LESS THAN INSIDE BOX HEIGHT

SCREEN HOOKS

G.I. FLASHING 2-3/4" WIDE AND FULL LENGTH OF TWO BOTTOM RAILS

4" G.I. GUTTER TOP GUTTER HAS 2 ROWS OF 16" HOLES PUNCHED IN BOTTOM 2" APART

ELECTRIC FAN DIRECTING COOLED AIR INTO HOUSE



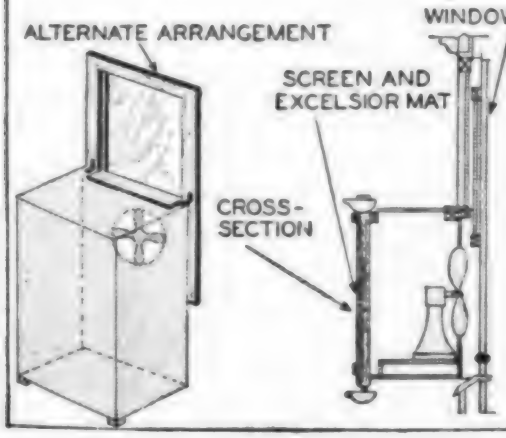
1"X2" RAILS

2"X2" STILES GROOVED FOR WIRE

HARDWARE CLOTH DOWN BOTH SIDES AND AROUND BOTTOM

INTERIOR SPACE LOOSELY PACKED WITH EXCELSIOR

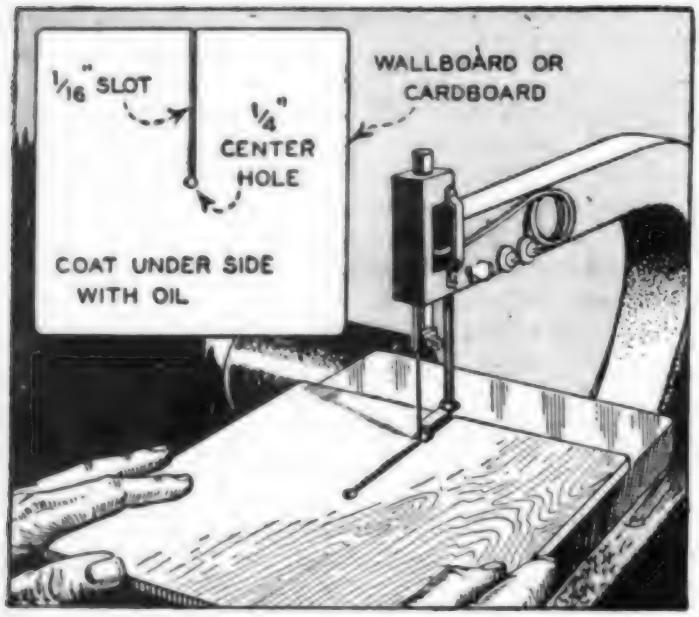
FILTER PANEL TO FIT TIGHTLY AGAINST BOX, WITH LOWER INSIDE RAIL RESTING ON EDGE OF BOTTOM PANEL OF BOX



— LIST OF MATERIAL —
— FOR 30"X48" EVAPORATIVE COOLER

ITEM	QUANTITY	SIZE	SPECIFICATION
FRONT PANEL	1	30"X47-1/2"	CUT FROM 1 4'X8' PANEL 1/4" PLYWOOD OR 1/8" FIBER BOARD HARD PANEL
TOP PANEL	1	18"X47-1/2"	
BOTTOM PANEL	1	18"X47-1/2"	
END PANELS	2	18"X30"	
FRONT RAILS	2	2"X2"-46"	S4S CLEAR WHITE PINE OR REDWOOD
BACK RAILS	2	1"X2"-46"	
SIDE RAILS	4	1"X2"-17"	
TOP RAILS	2	1"X2"-14-1/2"	
CORNER STILES	4	1"X2"-28"	
BOTTOM STRIPS	2	1"X2"-18"	
FAN HOLE FRAME	2	1"X2"-28"	
FAN HOLE FRAME	2	1"X2"-18"	
FAN SUPPORT	2	1"X4"-17"	
SCREEN STILES	2	2"X2"-32"	1/4" MESH HARDWARE CLOTH
SCREEN RAILS INSIDE	2	1"X2"-47-1/4"	
OUTSIDE	4	1"X2"-47-1/2"	
SCREEN		45"X63"	
SCREEN FLASHING	2	2-3/4"X47-1/2"	26 GAGE GAL. IRON
TOP GUTTER	1	4"-36" LONG	1/2 ROUND G.I. GUTTER
BOTTOM GUTTER	1	4"X4' LONG	1/2 ROUND G.I. GUTTER
GUTTER ENDS	4	4"	WITH 2" OUTLET AND END SUPPORTS
SCREEN HOOKS AND SCREW EYES	4	3"	

SHORTCUTS FOR

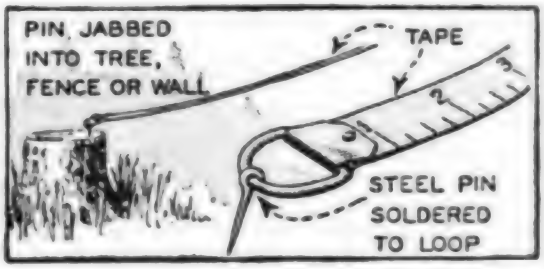


Cover Keeps Scroll Saw Table In Good Condition

AN OILED cover slipped over the table of the scroll saw during periods of idleness is good insurance against any possible rusting or tarnishing of the polished surface. If your saw is located where any moist air might cause damage to the table such a cover will afford perfect protection. Scribe the outline of the table on a piece of wallboard or heavy cardboard and cut it out. Drill a ¼-in. hole in the center and saw a slot 1/16-in. wide from the middle of one side to this hole. Apply a thin film of oil to the bottom of plate and slip over table.—*W. C. W.*

Ring On Crowbar Saves Fingers

WHEN prying heavy objects with a crowbar one is liable to mash or injure the fingers if the bar slips and snaps back toward the ground or floor. This can be avoided by welding a steel ring to the bar as shown, about 6-in. from the top end. With the ring in place the bar can bang against other objects and the fingers will be adequately protected.—*A. H. W.*



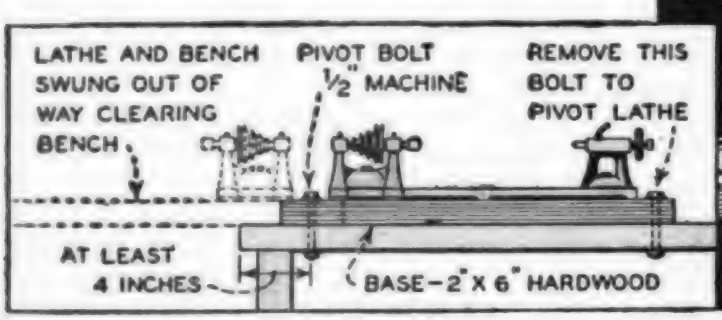
Pin On Tape Measure

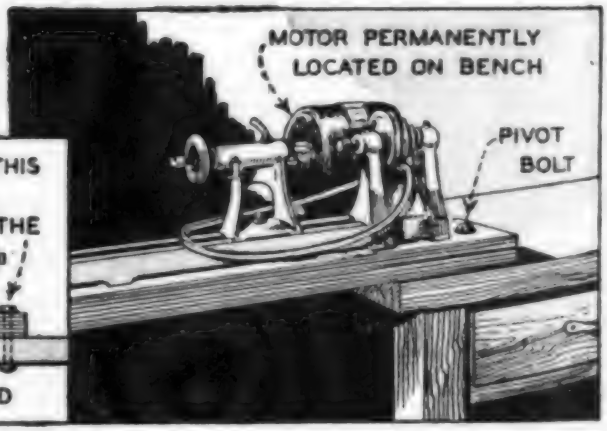
IT NORMALLY takes two men to measure off a plot of land with a 50 or 100 foot tape. By providing a simple pin on the loop at the end of the tape, one man can do the job alone. Fashion a steel point from some piece of steel wire or slender rod and bend one end over like a cane handle. Then solder to the loop as indicated.—*L. B. R.*

Lathe Swings Out From Bench To Clear Top

BECAUSE of the arrangement of the bench in the shop the only convenient place I could mount my wood lathe was near the left end and I found that the long bed took up a great

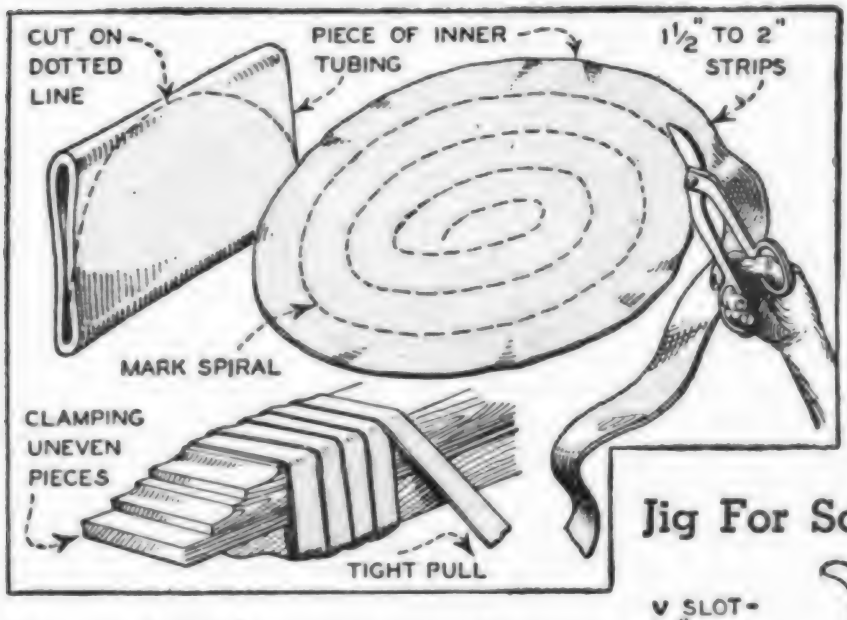
[*Continued on page* 144]





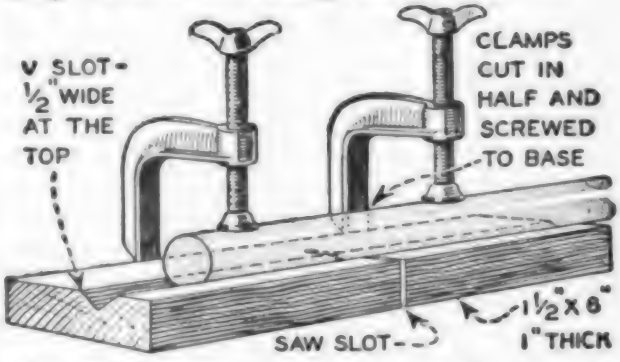
WORKSHOP FANS

Rubber Strips Are Powerful "Clamps" For Irregular Work



IT IS frequently a problem to apply even pressure to irregularly shaped objects that are being glued together. An effective solution to the difficulty is shown above. Cut a disc from an old inner tube and then slice it into one long rubber strip, following the dotted lines on the drawing. This strip can be wrapped around the work with considerable tension, holding it firmly.

Jig For Sawing Dowels



A JIG for sawing dowels, round pieces of metal, etc., can easily be made from simple materials. The bottom parts of C clamps are cut off with a hack-saw and two holes are drilled so that they may be fastened to the base. A "V" slot is then cut the length of the base directly under the holdown clamps. —*R. F. K.*

Accurate Measurements Of Slots And Key Ways

BY MEASURING the widths of slots and key ways in shafting and other work with a micrometer, perfectly fitting keys or guides may be produced without cut and try methods. The sketch shows some methods used by the writer to enable the micrometer to be used for this purpose. Part of the drawing shows an open key way. Two short pieces of drill rod or other true rod are laid in the bottom with about 1-in. protruding. A larger diameter rod is laid over the other two and held down firmly with the fingers or with a clamp or heavy weight. This large rod forces the smaller ones outward as far as possible and holds them in place while the caliper is used. The use of a small butt hinge instead of the rods is also

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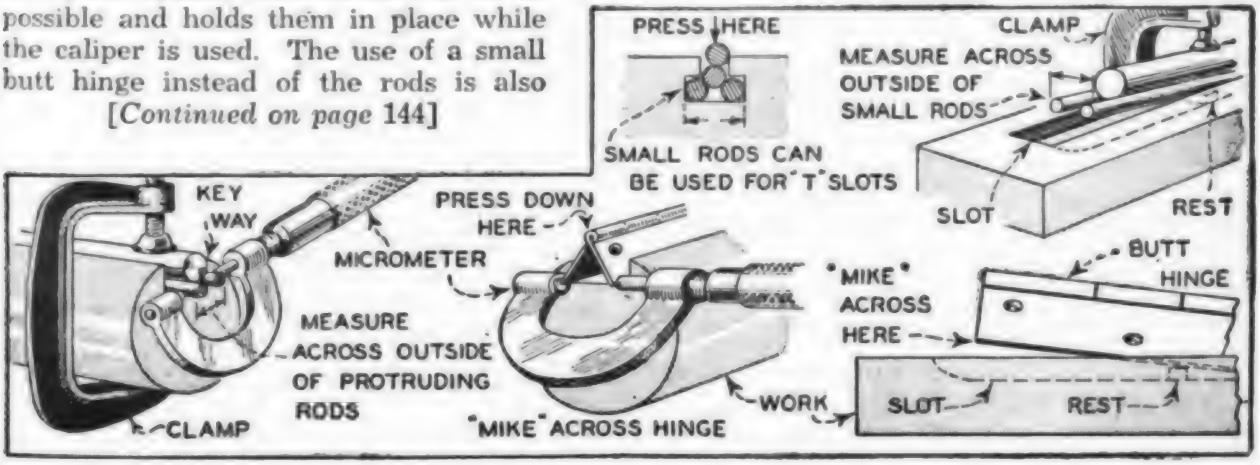
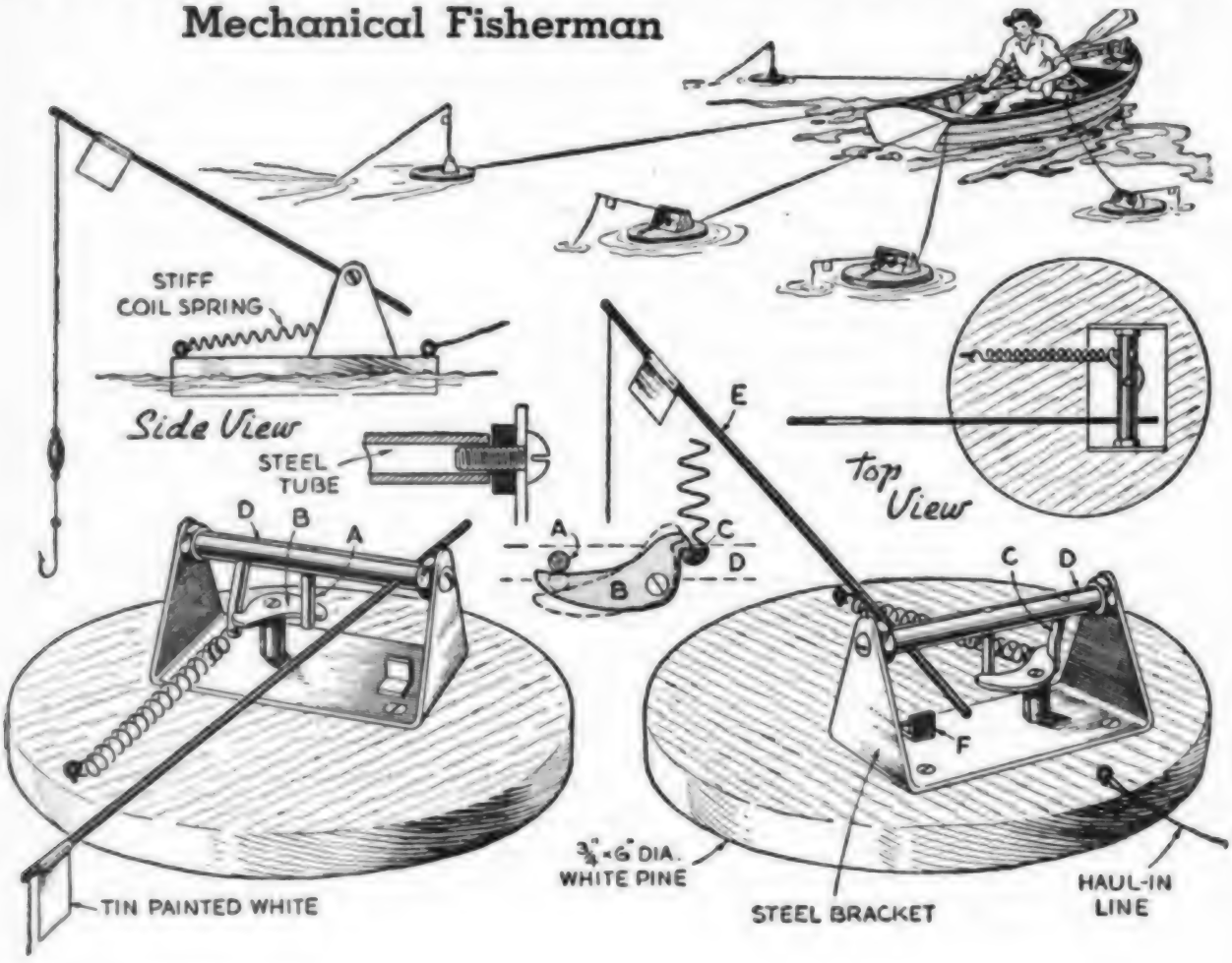


ANGLERS' AIDS—HOME MADE

Mechanical Fisherman

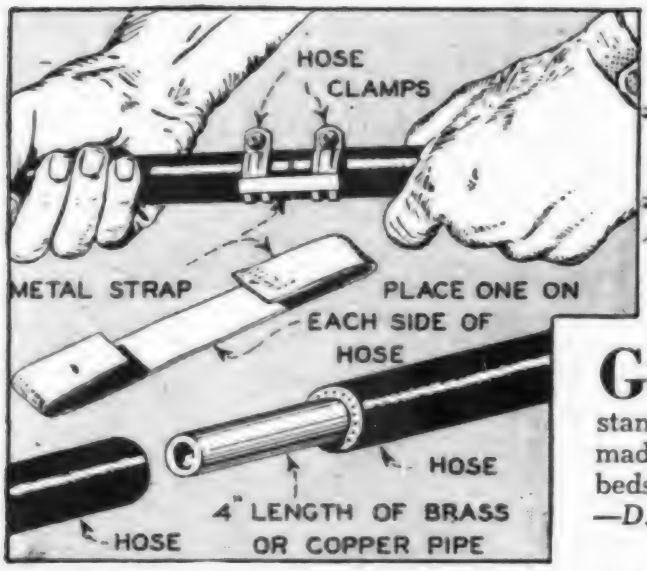


WITH the fishing grounds "mined" with these automatic fishermen, even the lazy angler should be able to make a good day's catch. The actual "rod" is a bicycle spoke inserted through a steel tube (D). The end bearings, which are made from bolts, are shown in detail in the drawing. When the hapless fish pulls on the line at the end of the spoke rod, pin (A) pulls trigger (B), releasing the pin to which the spring is attached. This jerks up the rod and its white signal flag, and imbeds the hook in the mouth of the fish. The entire mechanism is mounted on a 6" white pine disk ¾" thick. The stop (F) in the drawing, prevents the rod from turning all the way over. Strings attached to the disks enable the fisherman to haul in his "mine field" as catches are made. The devices should be kept well oiled at all times to insure proper operation and to prevent rust. If they are to be used in choppy water, the trigger mechanism may be made slightly less sensitive.—*Hi Sibley.*

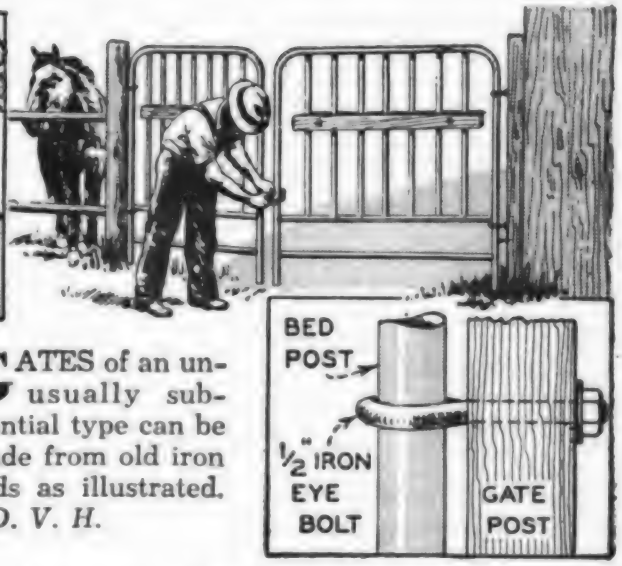
Hook Kit From Hose

A PIECE of ordinary garden hose about 6" long, with a cork in both ends, makes a handy hook kit for the fisherman. The hooks are inserted in the cork at one end with the leaders held to the sides of the hose by a rubber band to prevent tangling. Small sinkers, etc., can be kept inside of the hose and removed through the free end.—*B. B.*

A Non-Fraying Hose Clamp • Fence Gates From Iron Beds

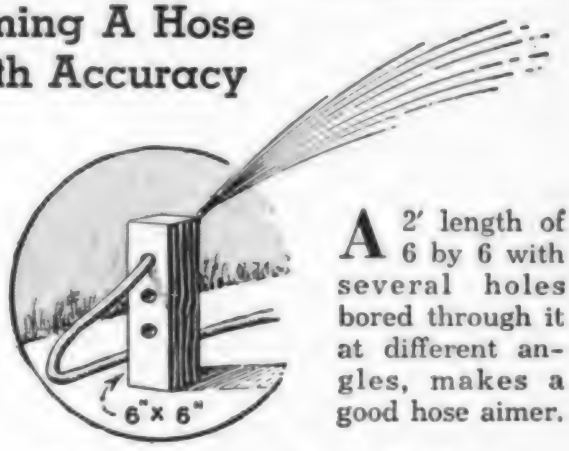


WHEN joined by a coupling of the type shown above, a hose is less likely to become frayed or to leak at the joint. The clamps are slipped up close to the ends.—*B. B.*



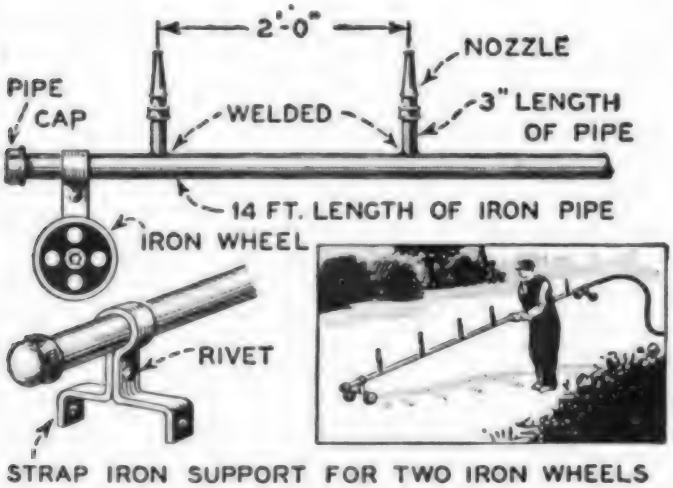
GATES of an unusually substantial type can be made from old iron beds as illustrated. —*D. V. H.*

Aiming A Hose With Accuracy



A 2′ length of 6 by 6 with several holes bored through it at different angles, makes a good hose aimer.

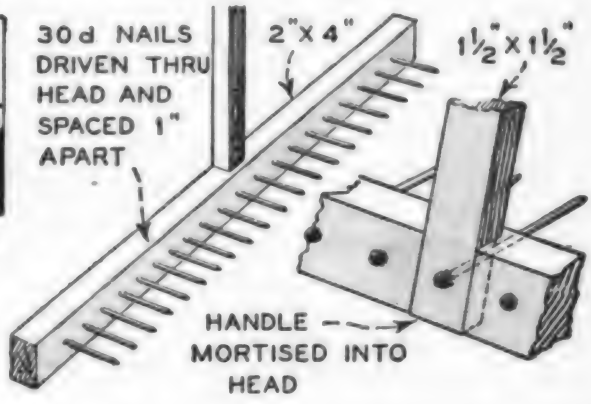
Covering More Ground With A Garden Hose



A 14-FOOT length of iron pipe with a half-dozen 3-inch length of pipe welded into it makes an effective multiple spray for the lawn. Nozzles are screwed on the short pipes, which must be threaded for the purpose.

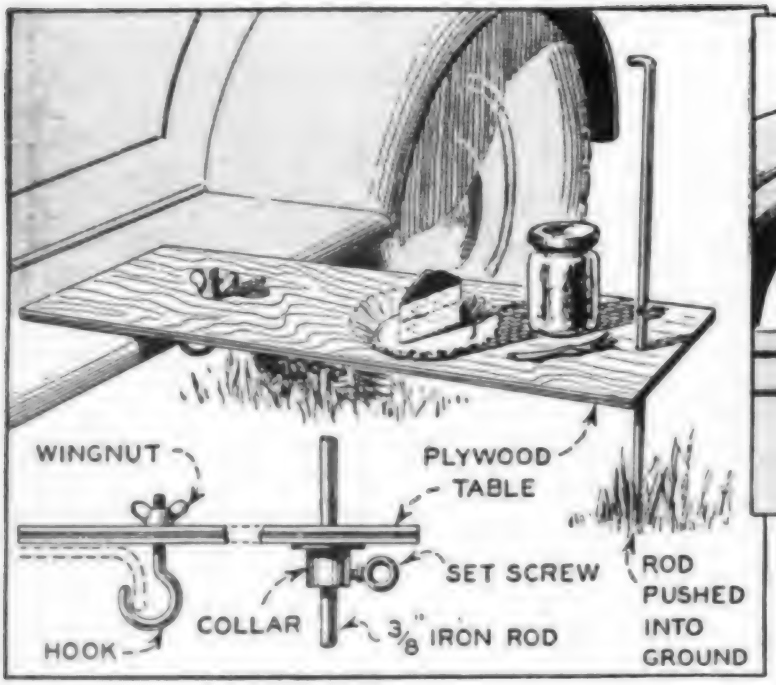
The outer end of the long pipe is capped and the other end connected to the garden hose. Small iron wheels mounted as shown aid considerably in moving the sprayer from one point to another on the lawn. The device may be moved in operation with the hose.—*D. V. H.*

An Inexpensive Rake



A RAKE for "lawn cleaning" can be made for a few cents from a two by four about 30 in. long with a 1½"x1½" piece of lumber of suitable length mortised into it for the handle. To form the rake head itself, 30d nails are driven through the 2x4 from the top, spaced about an inch apart.—*J. S. K.*

Running-Board Picnic Table For Outings



A RELIABLE picnic table can be made for motor picnics as shown above. The table, itself, is made of a piece of plywood from ¼" to ½" in thickness, depending on the size table desired. If the table is to be a large one the ¼" material would be too flexible. Regular shelving stock may be used with good results also.

The adjustable iron rod which forms the outer support for the table is easily set at varying distances to provide rigidity on uneven ground. The collar containing the set screw for adjustment can be made from a small pipe flange, tapped to take a suitable screw. The screw hook can be bought in any hardware store as can the wingnut.— *W. E. B.*

House Mop Makes Simple Car Cleaner

A MOP can be used as shown above to clean a car. It may be used wet for washing, or dry for dusting and polishing.—*R. L.*

Checking Connecting Rods

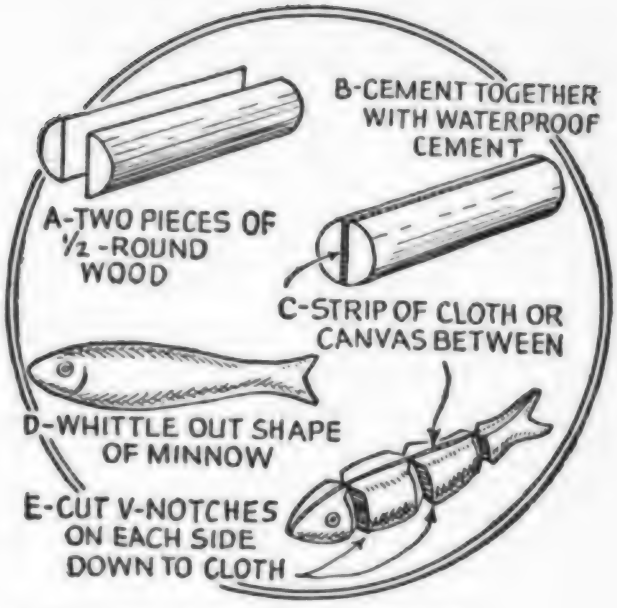
CONNECTING rods that are out of alignment often cause unnecessary wear on both the pistons and their bearings. Naturally, the cylinders also suffer. Alignment is not difficult to check, however, as the illustration at the right indicates.

Either wood or metal rods may be used for the purpose, although metal ones are somewhat superior. The advantage of the wood is its convenience, no metal turning being necessary. If the wooden rod is oversize do not attempt to reduce it with a plane. Turn it down on the lathe. Be sure that both the upper and the lower rods fit tightly into the bearings. Before setting the rods in place "sight" them for straightness with one eye shut.

Measurements should be made between the two rods from points at equal distances from each side of the piston. If the measurements are unequal, the rods should be straightened. —*I. J. S.*

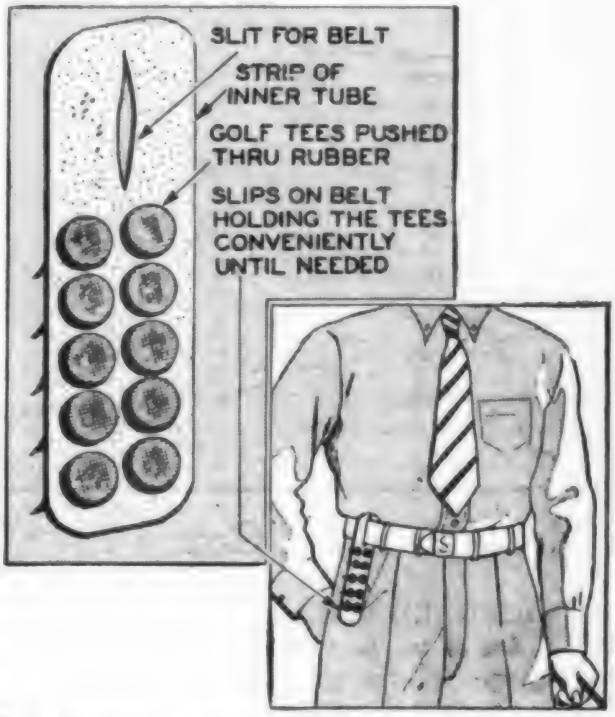
Wiggling Minnow From Wood And Cloth

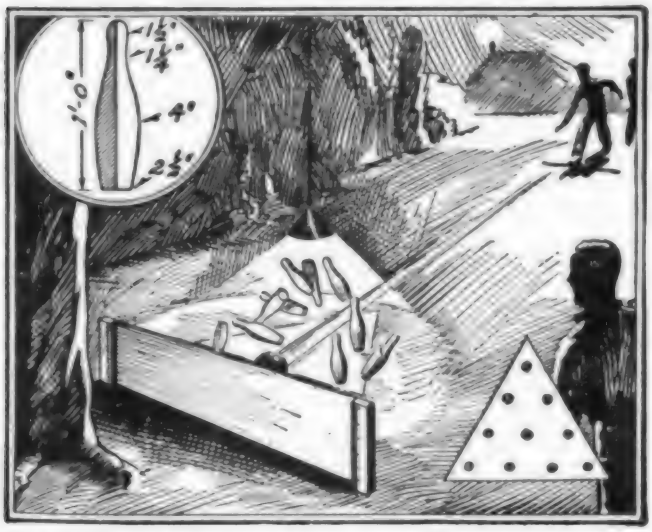
AN EXCELLENT wiggling minnow fish lure for bass, pike, or similar fish can easily be made from two pieces of half-round wood moulding. The pieces should be cut to the approximate length of a minnow and glued together with a strip of canvas or cloth tape between them. Naturally, only waterproof glue can be used. After the glue has hardened, the carving is done with a sharp knife. When the proper shape is attained, notches are cut in the sides to enable the lure to flex. Care must be taken in cutting the notches so that the cuts will penetrate the wood to the cloth but not cut the cloth. When the entire carving and notching job is completed the lure should be painted in bright colors with a fairly good grade of paint. After a few of these little wigglers have been whittled a greater degree of proficiency will be attained. Hook under tail.—*A. H. W.*



Inner Tube Strip Makes Tee Holder

THE elusive golf tee is effectively held in this simple little belt magazine. A strip is cut from an old inner tube and slit at one end so that the golfer's belt can be slipped through it. A number of holes are made in the strip to accommodate the tees. The holes should not be made as large as the stems of the tees, but smaller in order to grip them tightly and prevent their falling out when the player is moving. The tee holder may be attached to the golf bag instead of the player's belt, if desired.—*A. H. W.*





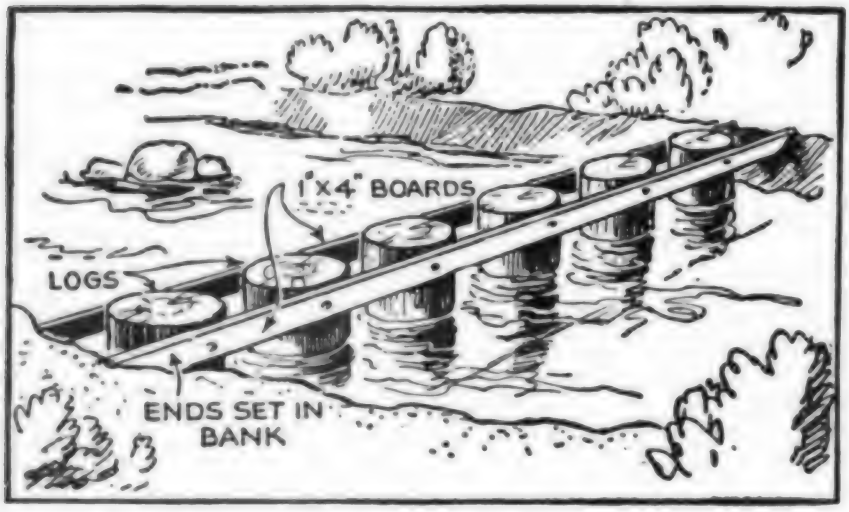
Lawn Bowling Alley From Plywood

DON'T let hot weather interfere with the fun you get from bowling. With a platform set up on the lawn under an extension light, and a level strip of clipped lawn, you can enjoy a few games at night whenever you wish. Select a suitable place in the back yard or lawn near the house, with a tree at one end if possible, from which to hang the light. Drive two 2"x4" stakes in the ground, 9' apart. Draw the ends of a strip of heavy canvas or tar-

[*Continued on page* 144]

Fisherman's Log Stool

THIS stool provides a convenient seat for the fisherman who likes to go after bullheads or catfish where the banks are muddy. The construction consists entirely of materials available at the fishing site or camp. The seat is merely a "slice" of a log about 8" in diameter. A short straight limb is driven into the center of the seat to form the leg. The hole should either be tapered or stopped about ¾ of the way through. A ¼" iron rod driven into the lower end of the leg protrudes about 5" out of the bottom. When the fisherman sits on the stool the rod is forced into the ground. The gadget is easy to carry and will support the stoutest of fishermen.—*D. V. H.*

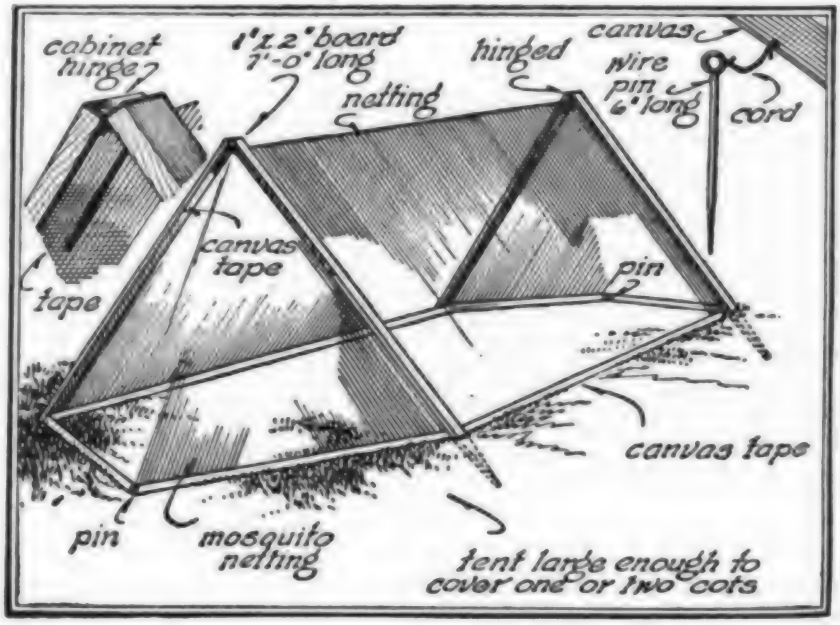


Log Bridge For Streams

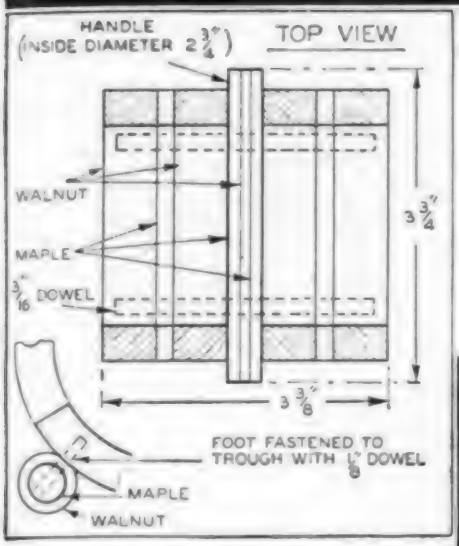
AN ARTISTIC and reliable stepping stone bridge can be built in rustic style as shown, from a few logs and a pair of planks. The logs are cut to a length slightly greater than the depth of the stream and held in place by the planks, through which spikes are driven. The ends of the planks are set in the stream banks. Logs of about a 10" diameter should be used to assure firmness.—*D. V. H.*

Mosquito-Proof Camp Tent

ORDINARILY the chief foe of the fair weather campers is the mosquito. This net-tent, however, defeats the singing pest before it can reach its victims. The plan shown calls for a total of 28' of 1"x2" stock, known as "shingle lathing." This type of wood can be had for as little as a cent per foot. The 7' pieces are hinged at the top as shown. About 15 or 16 yards of mosquito netting will be required, stitched together to form one piece of the area indicated. Wire pins are used to hold the taped edges to the ground.—*G. E. V. H.*



Two-Tone Cigarette Server



Sketch above shows dimensions and general assembly plan of the cigarette server.

You can get the cigarettes out of this handsome modern server without having to know a combination or go through any physical contortions.

Cutting the glued-up shell to form parts for trough.

BEAUTY and utility are combined in the modern design of this novel cigarette server. Construction begins with the trough. Cut 2 pieces 3⅞" in diameter from ⅝" walnut stock and 1 piece, same diameter, from ⅛" maple stock. Glue these discs together with the maple disc between. When thoroughly dry, mount on the faceplate of the lathe, smooth off the outside and turn out the inside, leaving a shell ½" thick. Cut this shell into 3 equal parts and discard the one section.

Now you are ready to make the handle. Turn 1 walnut ring ⅛" thick to an outside diameter of 3¾" and an inside diameter of 2¾". Next turn 2 maple rings to the same

[*Continued on page* 126]

Above: Sanding server on a small drum sander. Right: Turning the feet on the lathe.

The MI

Countless home workshop fans have no satisfactory means of sharpening dull or burned twist drills. Here is a simple drill grinding attachment for any grindstone. It can be easily made from a hinge, a few nuts and bolts and several cents worth of iron. It will handle drills up to half an inch in diameter. The results are equal in every way to those obtained at the factory.

by Kenneth Murray

Fig. 1. Drill sharpening is easy with a SIMPLEX.

CONSIDERABLE unnecessary expense is incurred by the average home shop enthusiast through lack of equipment to sharpen worn twist drills. Except in cases where the hobbyist has had commercial production experience the ability to sharpen drills "free hand" is usually not satisfactorily developed. The initial cost of a drill-grinder is prohibitive for the average home shop. About the only practical way is to compromise with both methods, the Simplex Grinding Attachment being designed for readers of MECHANIX ILLUSTRATED to accomplish that purpose.

The Simplex lacks such refinements as a drill stop, angle calibration and micrometer feed, for the good reason that these features would make the device complicated and difficult of construction by the average person. Free-hand work is *too* free hand, subject to too many errors without long practice and skill. The Simplex was designed to fill the gap, and it does this admirably. It is very easy and very inexpensive to construct, and very simple to use. After it is bolted to the grinder base, at the correct distance and angle, operation is simplicity itself. Merely slide the drill in place and it is automatically centered. Align one lip with the surface of the wheel and a slight pressure sharpens the cutting edge; then tighten the clamp and lower the drill holder, and exactly the right amount of clearance is ground from the heel. The other side is treated in the same manner, all within a few moments, and the tool is razor-sharp, ready for fast, clean drilling.

CONSTRUCTION

The self-centering drill holder consists of a piece of one-inch angle iron about three inches long. With a hack saw or metal-cutting band saw, cut each side of one end at an angle of about 60 degrees. This has nothing to do with the angle at which drills are sharpened; the metal is cut away so that it will not come into contact with the grinding wheel when it is in operation. Drill a small hole near the point thus formed, as indicated in the drawings, and countersink it for a short flat-head machine bolt, so that the latter will fit exactly flush with the surface and will not interfere with the centering of various-sized drills. With the aid of a vise, bend a short piece of $\frac{5}{8}$-in.-wide strap iron into a U-shape to fit over the middle of the angle iron piece.

The strap iron serves as part of a hold-down with which drills are centered and held in the holder. The other part required is the screw and button removed from a small

"Simplex" Drill Grinder

10c "C" clamp. To part the button from the screw, turn the latter to the left, using pliers if necessary, until they separate as in Fig. 3. Drill a hole in the center of the strap iron and either thread the hole with a tap, to fit the screw, or solder a suitable nut over the hole on the underside. The most convenient and certain method of doing this is to tin both the nut and the strap iron, about the hole, and hold them in good contact with the screw while heat is applied with a clean soldering iron. A little oil on the screw will prevent it from being coated with the solder.

Rivet the button back onto the end of the screw, with the latter turned into the strap iron, and with a triangular file make a notch in the face of the button. The strap iron can then be replaced over the middle of the angle iron and held there securely by bending down the ends.

Move the strap-iron clamp to one side with a hammer and drill a hole, of a slightly larger size than the clamping button, into the bottom of the angle iron. It should be deep enough to seat the button when the strap iron is moved back in place. Several such holes may be provided, if desired. They make it possible to screw the button well down into the "V" of the angle iron, so as to grip the very smallest drills and hold them securely. The notch cut in the button is an aid in centering such small drills, although it need not be used when tightening large drills in the holder.

An ordinary butt hinge, three inches wide, is used to support the holder so that it may be turned in an arc with the point of the drill at the axis. Cut away a part of one-half of the hinge, after removing the pin, and shorten the pin so that it may be riveted back in place. Fig. 4 and the drawings show how one corner of the other half of the hinge is bent at an angle. The corner must be bent so that when the holder is attached, the point of the angle iron will be exactly in line with the hinge pin. The hinge that was used in making the model illustrated was provided with a screw hole to coincide with the hole in the angle iron. The bolt used to attach them was fitted with a strong lock washer so that once adjusted in relation to each other, they would hold their positions.

A base must be provided to hold the hinge and drill-holder assembly so that the pin of the hinge is at exactly the same height as

Fig. 2. Use a vise to bend a length of strap iron partly around the angle iron.

Fig. 3. Removing the screw and button from a 10c C-clamp.

Fig. 4. A corner of the hinge must be bent at exactly the right angle to center the drill holder at the axis of the hinge pin.

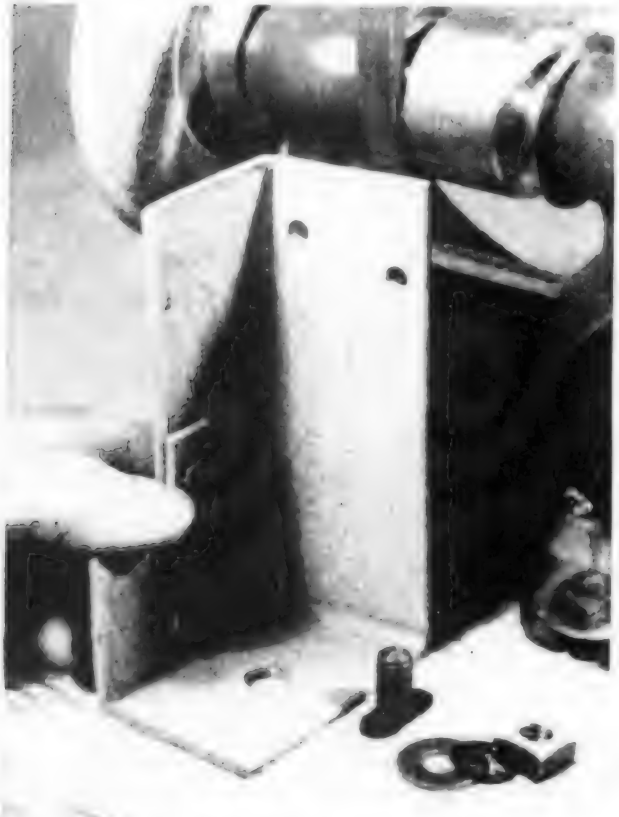


Fig. 5. Attaching the supporting bracket to the baseboard. A piece of 2" angle iron is the basis of the bracket.

the axis of the grinding wheels. In this case, the grinding wheels were mounted on an arbor with its center 5⅝ inches above the baseboard. The base of the Simplex Attachment is a piece of 2-in. angle iron with one end bent for mounting it to the baseboard with a heavy carriage bolt and lock washer. You can have the heavy angle iron bent, cut and formed by a blacksmith or tinsmith.

Bolt the hinge to the upper part of the base, then drill a hole at the center of the free side of the hinge and thread the hole for a machine screw and wing nut. As in Fig. 6, this provides a stop to limit the downward movement of the hinge and drill holder. After the device has been mounted in place and adjusted, the stop may be adjusted to the required limit of travel of the hinge.

Adjustment of the Simplex Attachment to the grinding wheel is not critical but it must be done accurately. Once set, it may be used in the one position for drills of all sizes. The size of drills that can be accommodated depends on the space between the clamping button and the bottom of the drill holder. If the strap-iron clamp has been given a slight outward curve in bending, there will be sufficient space for drills of up to ½ inch diameter.

USING THE GRINDER

Expert drill grinders always use the *edge* of the grinding wheel and not the side. The reason for this is obvious; the edge may be dressed down, while if the side is used continually, the wheel will soon become ruined. The one exception is when *cupped* or *recessed* abrasive wheels are used, and these more expensive wheels are made expressly for the purpose.

The easiest and quickest way of adjusting the Simplex to the grinding wheel is to purchase a new drill, fit it into the holder with the latter in a horizontal position (as in Fig. 7), and note the action when the shank of the drill and the holder are lowered (as in Fig. 8.)

Each cutting lip of the drill is ground at 59 or 60 degrees, and the holder is designed to keep the drill at this angle with the cutting lip to be sharpened in a horizontal position and all of it in contact with the edge of the wheel.

You will notice in Fig. 7 that the outside edge of the hinge pin is directly in line with the edge of the wheel. The drill

has been pushed forward, without turning it, so that the cutting lip contacts the wheel evenly. It is then clamped in place. On lowering the holder, if the device is correctly adjusted, the metal back of the cutting lip, down to the heel, will remain in contact with the grinding wheel.

In sharpening an old drill it is inserted into the holder, as above, with the clamping button slightly loose. With the cutting lip in a horizontal position, push the drill forward easily and gently until the lip is sharpened, and no more. Then immediately tighten the clamp and slowly lower the holder. This will grind off the excess metal underneath the lip and provide the necessary "clearance." Loosen the clamp, turn the drill over and sharpen the other side in exactly the same manner. One side must not, for ordinary purposes, be sharpened more than the other. Examine the sharpened drill closely to make sure that this is so. If one side has been sharpened more than the other, replace the drill in the holder and cut down the other side sufficiently to make both even.

For ordinary, every-day drill grinding, these are all of the instructions necessary. With very little practice, and retaining the new drill as a guide and check, you can learn to do perfect drill sharpening in a very short time.

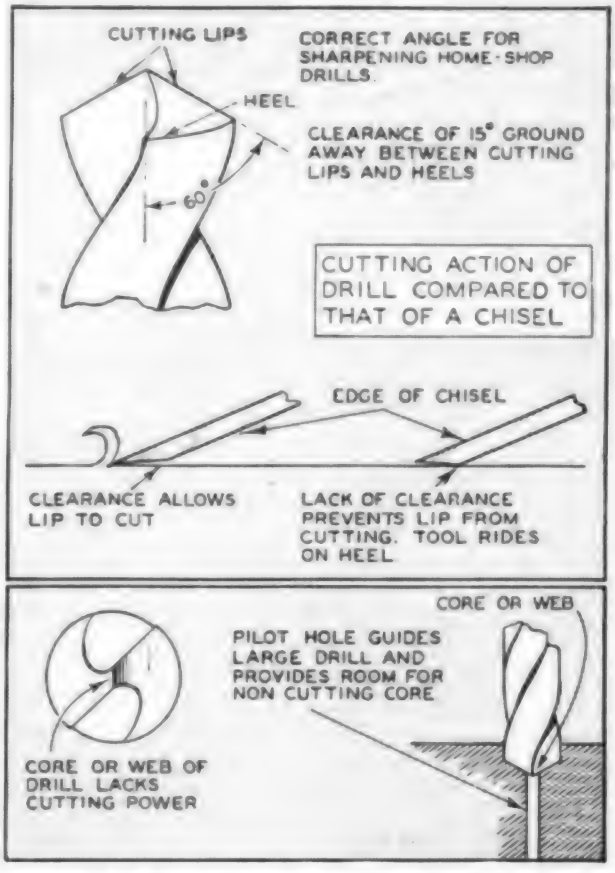
With the use of a factory-fresh drill as a guide, adjusting the simplex is an easy matter. If you wish, however, you may experiment so as to learn the effect of using the simplex in a wrong position as regards the wheel.

If the axis of the hinge is *too near* the edge of the grinding wheel, the latter will grind away too much clearance metal, or too much of the heel underneath the cutting lip. When the hinge axis is *too far* from the wheel, the cutting edge may be sharpened but not enough clearance will be provided.

Fig. 6. A screw and wing nut serve as an adjustable stop to prevent the drill holder from being lowered too far.

POINTS ON DRILL GRINDING

A drill appears to be a complicated tool, on first examination, but it is not so on further scrutiny. A way to fix the construction in mind, and better understand proper sharpening, is to consider it as an ordinary chisel which has had the misfortune to become twisted. If we used a chisel with which to drill holes, at the start it would cut very well. As the hole became deeper, however, the chips or waste would have no place to go and would pack up the hole, making further



How a drill does the work. The action is similar to that of a chisel. Clearance must be sufficient.

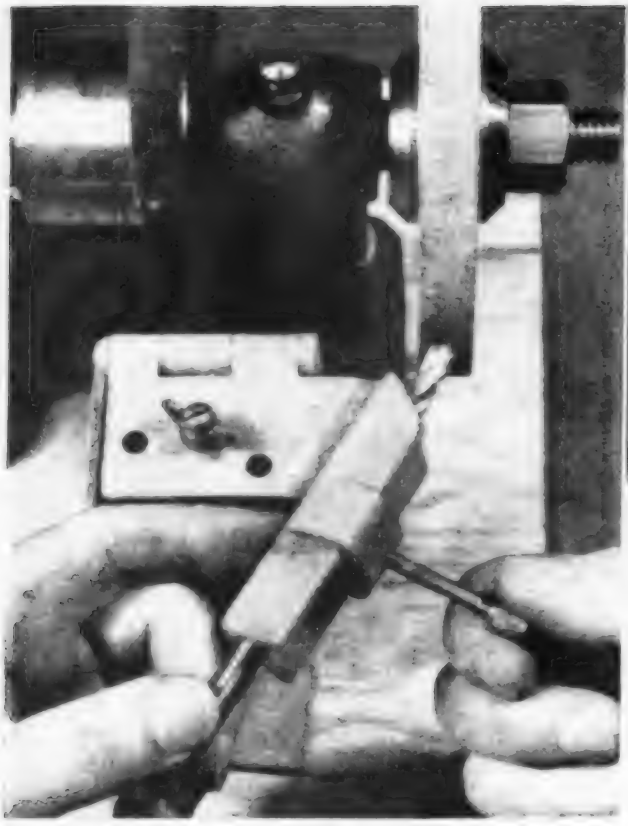


Fig. 7. A side view of the start. Note position of hinge axis in relation to edge of grinding wheel.

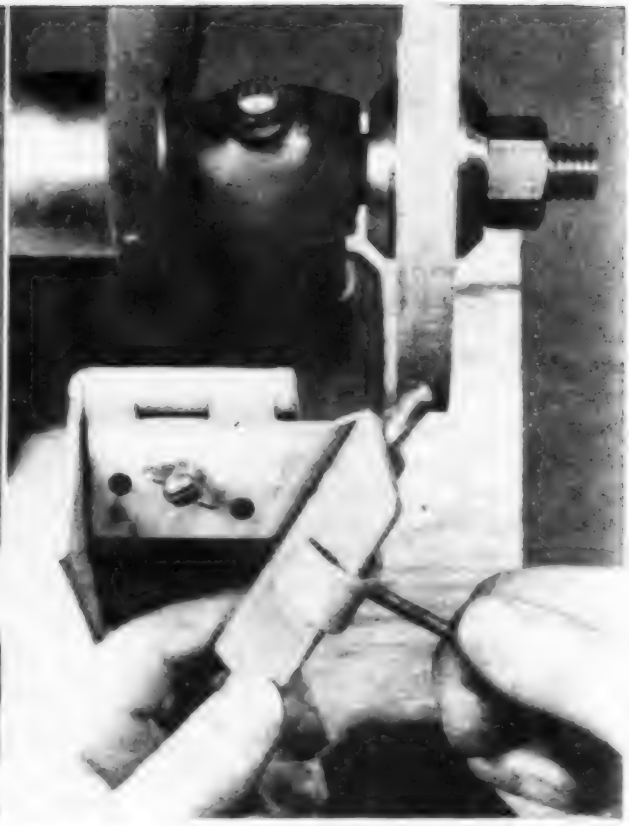


Fig. 8. The alignment of the drill tip to the edge of th grinding wheel is apparent in this picture. Various positions are possible with the Simplex.

cutting difficult. By giving the chisel a tight spiral twist, however, it would act as a screw and force the waste away from the point and out of the hole.

Just as with a drill, a chisel has a cutting edge and back of it a heel. Likewise as with a drill, if a chisel lacked clearance back of the cutting edge, it would not cut satisfactorily. Metal back of the cutting edge would ride on the material to be cut, refusing to allow the cutting edge to make contact and take hold.

Both sides of a drill should be sharpened the same. If one lip or cutting edge of a drill is ground more than the other, the latter will be forced to do all the work. In drilling metal, if the cutting edges are equal, an equal amount of chips will be ejected from each side. If only one spiral chip is ejected, remove the drill and re-sharpen both lips alike. The cutting edges are sometimes ground unevenly by deliberate intention, as they will then cut a hole that is slightly larger than normal.

GRINDING ANGLES

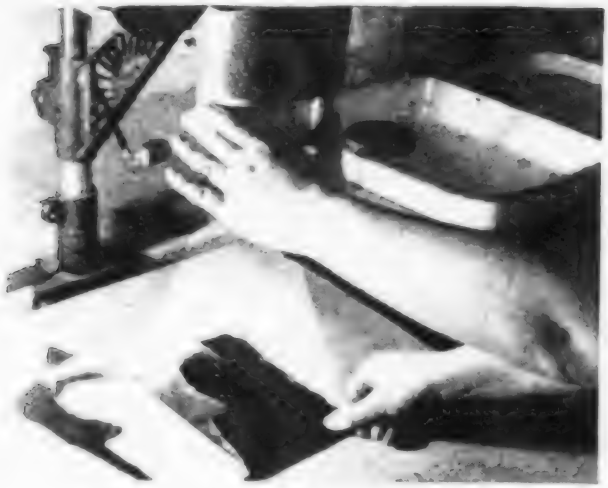
The standard angle at which to sharpen the cutting edges of a drill is 59 degrees, although 60 degrees is the angle usually adopted for convenience. This applies to average work; drills intended exclusively for wood will cut faster if ground to a sharper point, which can be forced into the material. Drills ground in this manner are not suitable for metal.

USING LARGE DRILLS

Power drill presses for the home shop are usually designed to use drills of up to ½ inch diameter, but when a large drill is used on a difficult job it may stall due to lack of sufficient power. The reason for this is evident from an examination of a drill point; at the center is a "dead" spot having practically no cutting power and requiring to be forced into the material to be drilled. The "dead center" becomes larger with the size of the drill, and also after a drill has been ground considerably. The inactive core of the drill, or web, becomes thicker as it approaches the shank; one way of reducing it is by grinding against the very edge of a wheel. If a job stalls under such circumstances it is a good plan to drill a smaller pilot hole, which will guide the larger drill and lower cutting resistance.

When drilling, it is always best to sink the drill in short jabs rather than a steady push, as the latter tends to clog the hole and overheat the drill.

Cutouts Take Out Backgrounds



by Louis Hochman

PHOTOGRAPHS with confused backgrounds can be remedied by the simple method of using cutouts, as described in this article. The sharp background can be blurred out of the picture in the darkroom when projecting the print.

To remove the background, simply place the negative in the enlarger and focus sharply on the easel. Then prepare a set of dodging masks by tracing the outline of the portrait or other subject on a sheet of black paper the size of the finished print. Now cut out the image. This gives you two masks: one to block the actual subject and the other to block the unwanted background.

Next, place the paper on the easel and with the enlarger's red filter over the lens. Lay the background mask on the paper, so that it completely covers the background projection of the negative right up to the edge of the portrait. Then expose for the necessary length of time, keeping the dodging mask in constant motion by a circular movement.

Next, replace the red filter over the enlarger lens and remove the background mask from the bromide paper. Then cover the portrait projection with the other mask, and before making the exposure for the background, throw it out of focus by raising or lowering the enlarger lens.

The second exposure is made exactly as the first, keeping the portrait mask in motion to avoid a sharp dividing outline. By exposing the two portions of the portrait negative separately, the resulting print will have a sharp portrait against a blurred background.

Unpleasant backgrounds in pictures like the one below can be removed by the simple method described in the accompanying article. Note in the photo above left, that an overlay, cut to block the image which you wish to retain, is the sole accessory used. The resulting photograph is shown above. Leave no rough edges when trimming the cutout strip.

"Helpful Hints Around

Pick-Proof Door Hook

THIS novel hook cannot be picked through a screen as can most hooks. No. 8 gauge wire is shaped to form the hook, then fitted with a spring and a short length of tubing, slotted as shown. For locked position the tubing is turned and pushed into place.—*B. N.*

All-Metal Thermometers May Be Adjusted

WHEN small dial thermometers are dropped, they are liable to be jarred out of adjustment. Adjustment can be made by removing the usual rubber suction-cup back and "winding" or "unwinding" the bi-metal thermostat spring which controls the position of the dial pointer.—*K. M.*

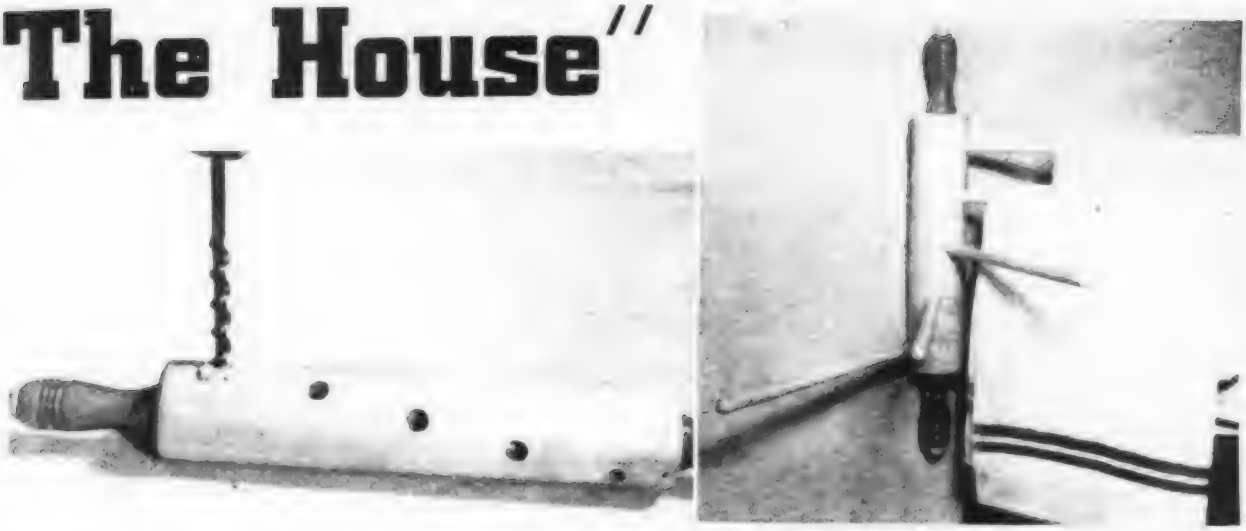
Scraper For Wall Cracks

A BEER can opener makes a handy scraper when preparing cracks in walls and ceilings for plastering. Wrap the handle with friction tape.—*W. S.*

Holder For Steel Wool

WHEN steel wool is used frequently, an excellent holder that provides a good grip can be made with a large crutch tip, size 18 or 20. When it is desired to use only a small part of the wool at a time, most of the ball can be packed inside the crutch tip.

The House"

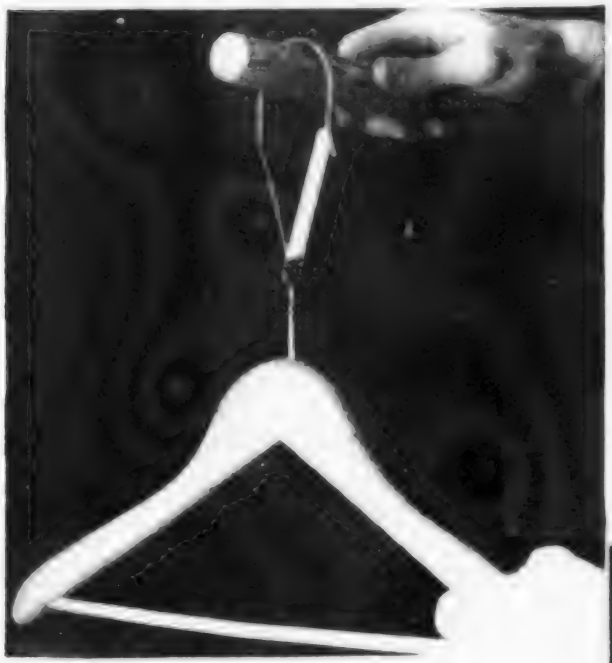


Towel Rack Has Rolling-Pin Standard

A HARD maple rolling-pin is used as the standard of this spiral towel rack. The arms are made from ½" dowels cut 12" long. The rack is hung on L-hooks.—*B. N.*

Varnished Candles

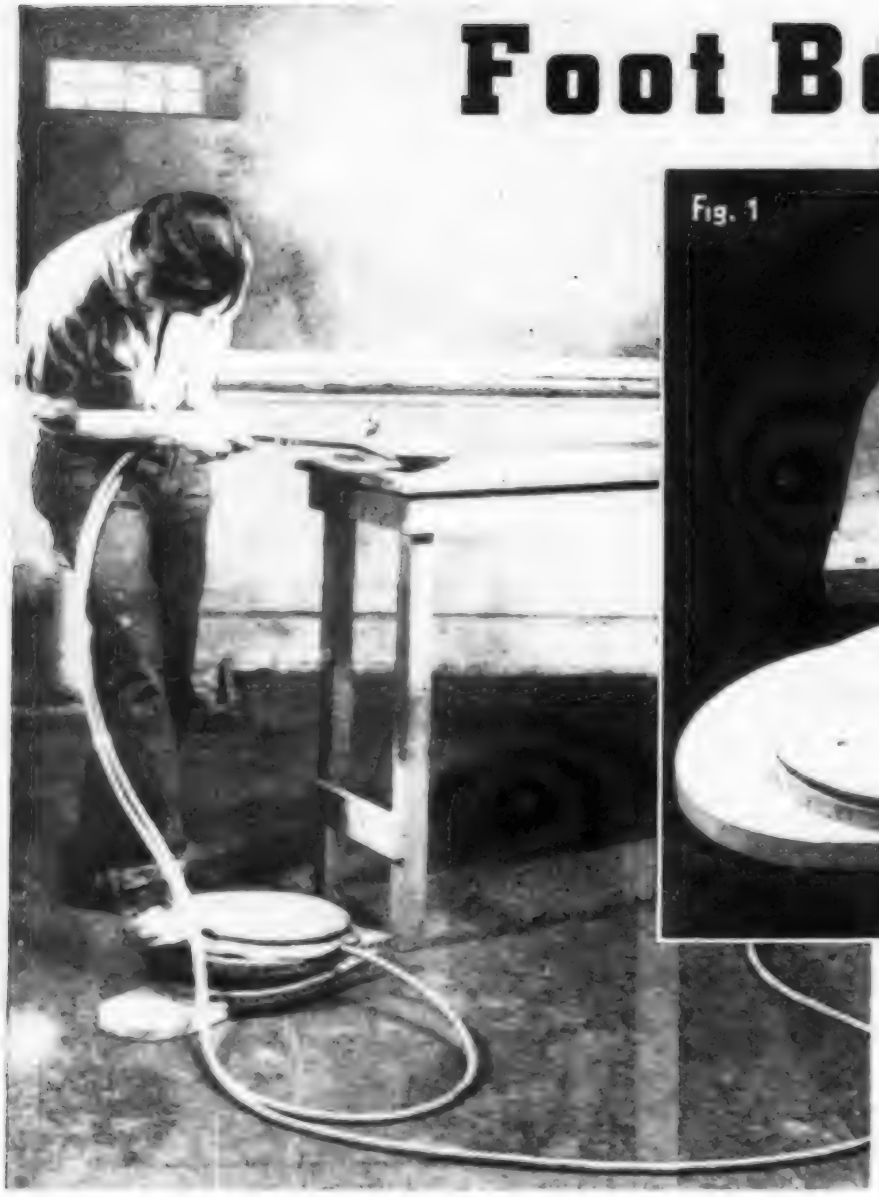
COAT your console candles with white varnish and you won't have any messy wax running down their sides.—*W. S.*



Hangers Will Not Fall Off Hook

THE annoyance of having clothes hangers fall off the pole can be avoided by removing the wire hooks with which the hangers are equipped and replacing them with hooks such as that shown in the accompanying photos.—*B. B.*

Foot Bellows



Large hole draws air through bellows into reservoir. Smaller hole sends it from reservoir into tube. Note cleats providing floor clearance for the bottom (top).

by
Harry L. Smith

AN EFFICIENT bellows that will furnish ample air to operate a blow-pipe for soldering, brazing, etc., can be made in a short time from odds and ends and will save the craftsman much labor and loss of time. Nothing is so exasperating as to be in the midst of a job and find that one hasn't the heat necessary for doing a bit of hard soldering, brazing, or perhaps some annealing. Uses for the bellows are many-fold and it is easy to make as well as being most inexpensive.

If the worker feels in an extravagant mood he can purchase new material for the bellows, but almost every shop will have a few odds and ends of lumber lying about, and it is no task to find a short length of tubing or pipe to serve for the air line take-off. A new spring is not necessary for the job. One can obtain for the asking at any garage an old valve spring which will do yeoman service at keeping the two parts of the bellows separated. The greatest point of economy, however, can be exercised in geting material for the diaphragm. Buy a manufactured diaphragm if you wish, but you can get an old inner tube at a tire station and out of it cut the diaphragm as well as the binding strip for the side of the bellows.

The complete bill of materials used:

2 pcs. 1x12x14 inches
1 pc. 1¼x11 inches diameter
1 pc. 1x6x9 inches
1 pc. 1x2x12 inches
1 pc. of tubing ¼x3 inches
2 small hinges
2 pcs. thin leather 4x4 inches (from an old boot, perhaps)
1 expansion spring (an old valve spring is fine)
1 pc. leather or rubber 14 inches diameter for the diaphragm
1 pc. leather or rubber 4x48 inches (edge binding)
Tacks and screws

For beauty as well as ease in assembly, a

For The Small Shop

Two halves of bellows hinged together with expansion spring in place. Top right: Lower valve in place and upper with one corner not yet tacked. Any leather but chamois will do.

semi-circle is drawn on the end of each 1x12 inch piece, and on the 1x6 inch piece, and the three boards are cut to that shape.

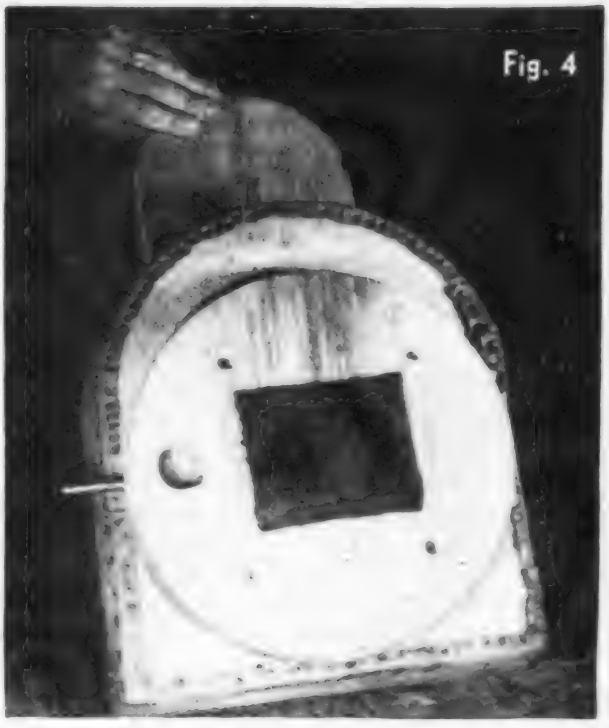
The piece of 1¼-inch stock is turned on the lathe to a diameter of eleven inches, and a groove ⅛-inch deep is cut into the piece ¼-inch from the edge to serve as a seat for the wire that holds the diaphragm in place. Glue and screw this round piece, which is the base of the air reservoir, to one of the inch pieces. Clamp all three together and saw or bore a 2-inch hole through the boards at the center point. If you haven't facilities for cutting a 2-inch hole a series of smaller holes will serve nicely.

A 1-inch hole is then bored through the air reservoir base an inch from the edge thus giving a place at which to draw off the air stored in the reservoir.

The 1x2 inch piece and the 1x6 inch piece are screwed to the bottom of the remaining piece of 1x12 inches to provide floor clearance so that air may be drawn into the bellows at the bottom. We now have our job at the stage shown in Fig. 1.

Fasten the hinges in place, mark the position of the expansion spring and bore shallow holes for seating it. The leather squares are tacked snugly over the center holes (one tack at each corner only). This

[*Continued on page* 126]



Edge bound with strip of rubber and top valve in place. Air line take-off tube projects from reservoir hole at the left.

Cut Your Own Lens Cap

AN INEXPENSIVE lens cap can be cut from a rubber cork, as shown. Cut the cork-end off with a knife and smooth the rough edges on an emery wheel. Trim opposite end with scissors, leaving a tab, by which the cap may be attached.

Two-Tone Cigarette Server

[*Continued from page* 115]

dimensions. Then glue these rings together, with the grain of the maple running opposite to that in the walnut to reinforce the handle. Assemble the trough sections and the handle with 3/16" dowels. Sand smoothly on a drum sander as illustrated.

For the feet turn a walnut stick to a diameter of ¾" and 2" long. Bore a ⅜" hole through the center and cut 4 pieces ⅜" wide. Slip these pieces on a ⅜" maple dowel and glue into place, spacing them ¾" apart. Run the maple dowel into the hollow shaft of the headstock on the lathe far enough to grip the dowel tightly, adjust the tailstock on the other end and start the cut for separating, cutting partially through while the lathe is turning. Now sand the feet and apply shellac. When the shellac is dry take the work from the lathe and hold the series of feet against a small drum sander, to give a concave surface which will make the feet fit neatly against the trough. Remount the series in the lathe, cut apart and smooth the ends. Attach the feet with ⅛" dowels.

Finish by sanding the whole server and applying 3 coats of shellac, rubbing down with fine sandpaper between each coat.—*Benj. Nielsen.*

Foot Bellows For Small Shop

[*Continued from page* 125]

is shown in Fig. 3 with one corner yet to be tacked in place.

The bellows may be sealed by using leather, imitation leather or rubber but NOT Chamois, which will leak. The piece of inner tube mentioned earlier has an added advantage here in that it is easy to fasten in place, and tends to seal the edges. Be careful not to leave a leak when you lap the ends.

Bore a hole for and insert the piece of tubing at right angles into the small hole in the base of the air reservoir. Fig. 3 shows the blower assembled and ready for the diaphragm. An extra pair of hands will be a help here in wiring it into place. Be certain you draw the wire down snugly into the groove cut for that purpose, and your bellows is ready for use.

Suggestions:

1. Don't make the diaphragm too small or you will have difficulty in holding a head of air.
2. If you tack the leather valves down too tightly your bellows will be slow in drawing; if too loose they will tend to breathe or leak slowly. If you tack the leathers so they are flat and just snug, you will have no difficulty.

Tests indicate that apple tree prunings make good cigarette paper.

Chemists Now Mine Metal From The Sea!

A typical sea water intake. From this point on through the vast extracting plant, myriad chemical processes will remove the valuable metal from the water. Millions of dollars worth of material will thus be retrieved from the realms of Father Neptune. Modern lightweight alloys for aircraft are made largely from metals which can be more readily obtained from the sea than from any other source. Numerous factories now employ this method.

After exploring this limitless domain of the sea for many years, chemists and technicians have brought back word from old Neptune himself that each one of his 320,000,000 cubic miles of watery storehouse contains some 175,000,000 tons of chemical combinations of such materials as gold, silver, copper, iron, magnesium, potassium, aluminum calcium, radium, strontium, chrome, bromine, iodine and sulphur. And each cubic mile of those materials has a potential value of some $5,000,000,000.

Until recent years layman and technician alike thought only of that other great god, Vulcan, who was supposed to hold a corner on the world's possessions. And it was Vulcan's favor that men sought. For, had he not forged great mountains of gold and silver, iron and copper and scores of other priceless metals on his fiery anvil for millions of years, besides spreading vast layers of precious deposits under the surface of the Earth? And not the least of these is magnesium.

The growth of the infant magnesium industry in America has been amazing, considering that it had its birth in 1915, only 25 years ago.

To one man in particular, the late Dr. Herbert H. Dow, goes a great share of the credit. Dr. Dow championed the cause of magnesium, third most abundant engineering metal in the earth's crust. His engineers and scientists learned how to alloy the metal and how to fabricate it. By constant improvement in production methods they developed Dowmetal. Following Dr. Dow's death in 1930, E. O. Barstow and a large group of associated research men have carried on the development of magnesium alloys.

Dowmetal, named after Dr. Dow, henceforth to be the product of both sea and land, is a silvery metal, one-fourth the weight of iron and one-third lighter than aluminum, possessed of great strength, toughness and durability.

The growing demand for the metal due to its wide use in the aviation, bus, railroad and general transportation industries, as well as in the manufacture of lightweight portable tools and its broad application to household and office appliances, is what brought on the immediate necessity of doubling the production of magnesium alloys.

To obtain this additional production industry has turned to the sea, where an unlimited source of magnesium exists. And incidentally magnesium can be recovered from sea water with less effort than from the land. In other words, Neptune has done the preliminary work by washing the magnesium into his ocean storehouse.

Extensive research and quiet investigation were carried on for many months to determine the best possible location to tap these inexhaustible resources. After studying many possibilities Freeport, Texas, was selected because of its natural advantages.

Availability of an unlimited supply of essential raw materials determined the selection of the site.

Old Neptune has been generous in making magnesium easily available. Every cubic mile of sea water contains 5,700,000 tons of magnesium. Operating at full capacity a new Freeport plant will have enough magnesium in just one cubic mile of ocean water to keep it going for 800 years.

Goose-Neck From No. 4 Copper Wire

HERE'S an idea that solves the goose-neck problem at very low cost. Obtain a three-foot length of scrap hard-drawn No. 4 insulated copper wire from the service department of the local power company. As shown in the photographs, strip the insulation off one end of the wire and solder it into the top draw-tube of a telescoping standard. The other end of the wire is stripped, bent at right angles, and soldered into a threaded nipple to fit the cap of a standard lamp socket. The connecting cord is connected to the socket through a hole in the cap, and the cord is taped to the goose-neck to keep it out of the way.

This goose-neck provides an adjustable arm that really holds the reflector rigid at any desired angle.

Two Heads Are Better

[*Continued from page* 49]

the Akron bankers with whom Bunting talked. But Bunting was willing to gamble. He resigned his job and its substantial salary. He held conferences with an attorney. Plans for organizing a company and selling stock were worked out. People still said "It can't be done"; but in two months practically all of the $100,000 worth of stock had been sold.

Bids came from other cities, offering factory facilities and money. But Bunting and the Funks had always lived in Akron, and they wanted to remain there. They rented, from the city, a large, abandoned schoolhouse that stands on a hill adjoining the Municipal Airport. Today, the rooms and corridors that used to echo to cries of children are now vibrating to the whine of metal saws and the hissing of welding torches. As this is written, one plane a day emerges from a large assembly hangar that was erected back of the school building, and points its nose toward Texas, California, Florida or some other destination.

The Funk Airplane, of which about 75 have been delivered to date, and for which orders extending for months into the future have been piling up, is a high-wing monoplane. It is not a light plane, even though it sells in the light-plane range. It is heavier, and is in the "2-S" class. Its cruising speed is 100 to 105 miles per hour. Because of its Prestone-cooled engine, it operates more economically than an air-cooled job of similar size. At cruising speed the engine uses four gallons of gasoline an hour. The ship has such features as a starter of special design, a new type T-head dual control, side-by-side seating, high visibility because of the streamlined engine and generous use of windows, and all-metal doors similar to those on automobiles. But the thing that makes Joe and Howard Funk happiest is that the ship almost flies itself, and will land on its wheels instead of its nose if the pilot suddenly goes haywire.

Such incidents as this attest to the soundness of the Funk Twins' theories: At Youngstown, Ohio, a 65-year-old man was being examined for his pilot's license. The inspector told him to go up, in his Funk plane, and then make a landing at a certain spot. The man went up all right, but excitement got the best of him. He killed the engine. He yanked back the wheel and held it there. The plane, carefully balanced for just such emergencies, pancaked down much like a parachute. It didn't land gently, but neither did it injure the pilot or do much damage to itself. The inspector said an ordinary ship would have crashed and probably killed the man.

Joe and Howard Funk no longer sell birds. They build them instead. Together they are the engineering brains of the company. Joe still works on engines and Howard on fuselages, wings and other parts of the plane proper. But they

[*Continued on page* 130]

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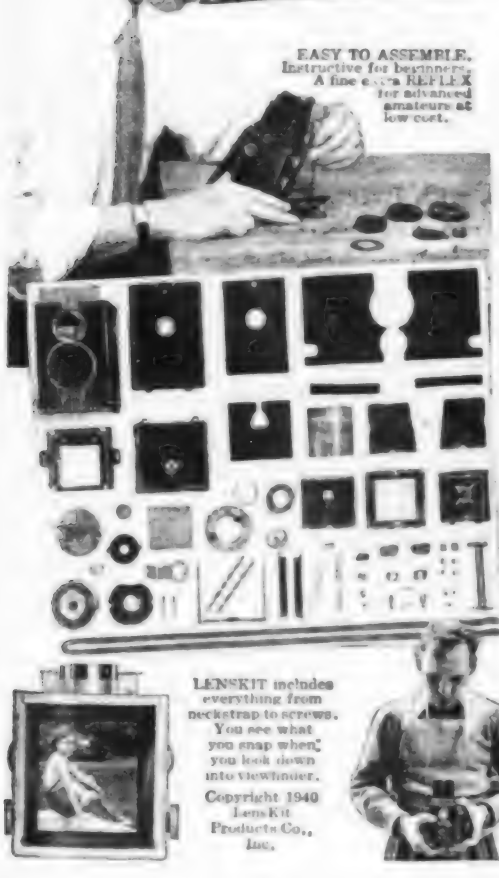

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Seals With A Sheepskin!

[*Continued from page* 63]

ship into his charges and impressing them with the advisability of doing their stints more slowly.

The seal can be considered tamed and ready for training as soon as he has been persuaded to eat via the fish-on-string method. The next thing in order is to get him to take things, other than breakfast, lunch and dinner, into his mouth. Once this is done, and the student snatches willingly at such objects as sticks, flags, rubber balls and similar bric-a-brac, Mr. Huling moves onto the next step, that of educating the seal to balance. This is difficult and consists of getting the young pupil to mount and dismount from pedestals, as well as walk a tight-rope. In the latter, the seal learns his art by crossing and recrossing the pool on a plank wide enough to accept the animal's flippers. Later he can be taught to combine this performance with balancing a ball on his nose.

Clapping with his flippers is next in order and, because this looks like a natural gesture, people are inclined to think it comes easily to the young starlet. Actually it doesn't, being one of the most difficult problems to overcome in seal training. However, when the performer has come this far in his training, he is considered versed in the rudiments, and it then is time to decide on the animal's future course, which is elective from here on in. Either he may decide to take up comedy, music, acrobatics, or—in specialized cases—a combination of all three.

Comedy comes most naturally to the denizens of the seal world, and, in Mr. Huling's opinion, they are born comedians.

"Their droll appearance gives them a natural advantage in so far as getting laughs is concerned," the trainer said. "Ted, for example, whom I've taught to say his prayers, get in bed and pull up the covers, and then wake up and start scratching himself with a flipper, now is learning to take a bath. I use a bathtub with special attachments, which he can turn on and off with his nose. I'm also teaching him to undress, get into the tub, turn on the shower, turn it off and finish by drying himself. During one rehearsal, I asked him as he emerged from the tub: 'Aren't you ashamed of yourself, walking around without any clothes?' Ted actually bowed his head in shame and covered his eyes with a flipper, much after the manner of a trained dog. Stunts such as these, burlesquing the actions of humans, have a sound theatrical psychology, of course, and are sure fire hits with an audience."

It is Huling's contention that seals actually learn musical notes in the horn-blowing course. Seal pipes, or seal horns—which the animals play in circuses and on the stage—are really seven small horns of graduated length, set side by side on a frame, and slightly rearranged to suit the particular number the seal has to play. This is done in order to enable the seal to get around the scale a bit quicker than he might if he were playing a regulation scale.

Incidentally, there are two schools of thought on horn blowing. One school holds that the seal actually should blow the horns, even as you and I, while a second group contends that, since seals are great on sneezing, a much better result musically will be produced if the animal sneezes through the horns. Mr. Huling admits that some of the world's finest seal concerts have been given by the sneezers, but, for the most part, he believes in teaching his charges both methods—blowing, for leisurely numbers, and sneezing, where the tempo is somewhat more lively. "My Country, 'Tis Of Thee" is one of the most difficult numbers for a seal to play, although "Where The River Shannon Flows" runs the former a close second.

Huling pointed out that balancing stunts taught at Seal College are more difficult than those he taught his pupils back in the days of the circus. Sharkey, Ted and several other star students can balance a glass of water on their noses without spilling a drop, while Sharkey will roll a ball back and forth on a grooved stick while rolling around in the water.

"None of them is ever perfect, though," Mr. Huling said. "I have to have even my honor graduates come back to the school from time to time for post-graduate work."

Two Heads Are Better

[*Continued from page* 128]

are versatile enough to overlap their fields if necessary.

The two, with Bunting, virtually eat and sleep airplanes. The Funk boys put in about 18 hours a day at it. They have no time for social activities or any other recreation, and apparently want none. They never even found time to get married, although they are 30 years old.

The Funk brothers attract no little attention because they are twins. But few people know that Bunting, who now heads the company, is an identical twin, too. His brother died in infancy. Maybe some moral could be discovered in the relation between twins and planes. At any rate, the combination of mechanical genius, twins, and the methodical transformation of a boyhood hobby into an engineering feat has given aviation a new airplane and engine.

Leaving out the Orient, one-fourth of the world's food consists of potatoes.

There are more than 10,000 airplanes in civil use in the United States, serving 70 kinds of business organizations.

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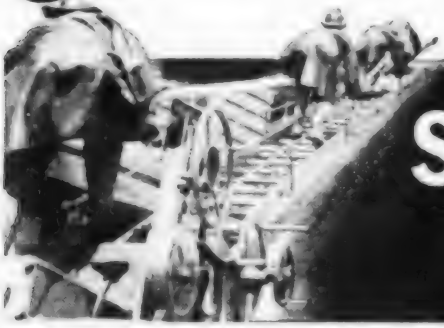

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Electrical Engineering

[*Continued from page* 39]

That means that as an electrical engineer you not only like analytical theory, but you have a yen to put theories to work. It takes imagination, inventiveness, engineering knowledge and good horse sense to take, let us say, a theory of electromagnetism and make a motor out of it.

"Let your imagination work and forget the critics of ideas," advises Dr. Willis R. Whitney, in charge of research of the General Electric Company.

If you have the makings of an electrical engineer, it is very probable that you already talk the language. That indicates a genuine interest in the field—you have picked up a great variety of information about electricity, already training your mind to become a vast storehouse of innumerable facts which the engineer has to acquire as mental working equipment.

Such terms as induction, shunt winding, turbo electric drive and scores of others are part of your vocabulary. And you won't be fooled into describing a generator as "a machine that generates electricity," for you'll know that the tricky definition is that a generator is a machine by which mechanical energy is changed into electrical energy.

Have you ever experimented with radio, and liked it? A surprising number of electrical engineers furthered a bent for electricity by tinkering with radio. Ernest O. Lawrence began with radio experiments, became interested in science, and went on to develop the famous cyclotron or "atom-smashing" machine. He could just as well have become a television expert or a turbine designer.

Arthur H. Compton started out to be a mechanical engineer, but he uncovered such exceptional ability in higher mathematics that he turned to pure science and fathered a fundamental theory about cosmic rays.

Almost everything that was said about mechanical engineering in the July issue of Mechanix Illustrated applies equally well to electrical engineering. Therefore we will dwell but briefly on the test questions dealing with your "human side."

Electrical engineering demands that you get along well with people because it is an extremely cooperative profession. It deals with no restricted type of industry, but with *all* industry. You need a broad cultural background because you'll be dealing with big men. You will have to persuade people, explain your ideas to them, lead them, and that demands a good English vocabulary and an understanding of what makes people tick.

One of the best signs that you have what it takes to manage and direct and get along with people is the type of activity broadly described as extra-curricular interests. This may mean managing a dance or staging a minstrel show or making speeches or any one of a thousand other activities which demonstrate your ability to organize people and get things done. It is obvious that you can't do things of this sort without winning the respect of people for your abilities, and such activities are as accurate a gauge of your broad background and high intelligence as the fact that you rank with the top third of your class in scholarship.

If you wish a more exhaustive analysis of your interest patterns than can be given in the MECHANIX ILLUSTRATED aptitude test, write the Engineering Foundation, 29 West 39th Street, New York City, and ask for tests which will enable you to compare your interests with those of men who have made their mark in the electrical field. Ask also for a copy of "Engineering—A Career, A Culture," which will give you a splendid detailed picture of just what engineering really is.

Since no person in one liftetime can hope to become equally proficient in all branches of electrical engineering, let's see what the main fields are so you can get an idea what branch is most to your liking:

Research Engineer. This is the chap who evolves and tests theories in the laboratory, with only a secondary interest in whether or not his discoveries are of any commercial value. Personality qualities are not so important to him, but a superb background of science and mathematics is indispensable. He usually works for a large corporation which can afford to spend money for which there is no immediate return. Michael Faraday, when officials asked him why he wasted time in studying useless theories of electricity, expressed the attitude of the born researcher in his retort: "Some day, gentlemen, you will be able to tax it."

Manager. Public utilities and private plants need managers who are also electrical engineers. Equipment under one man's supervision can be worth millions of dollars. This type of job requires specialization in the particular type of machinery being used. It also demands organizing and executive ability and a knack for managing people. Men in this field often rise to top spots in industry. David Sarnoff, beginning as a radio operator, is now head of the vast enterprises of the Radio Corporation of America.

Development Engineer. He's the man the public rarely hears about, but all engineers respect him. When a new mechanism is being designed, whether it's a dynamo or an electric toothbrush, the development engineer makes the complicated calculations, makes plans, specifies sizes and materials, and follows the item through testing and into production.

Manufacturing. Close kin to the managing and development engineer (all types overlap), the engineer interested in manufacturing processes will find plenty of demand for his services in large

[*Continued on page* 134]

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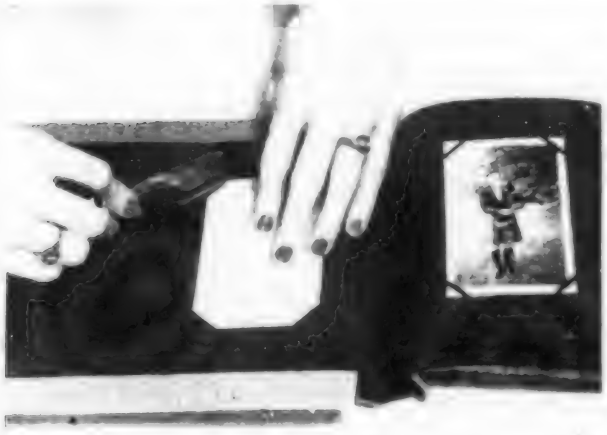

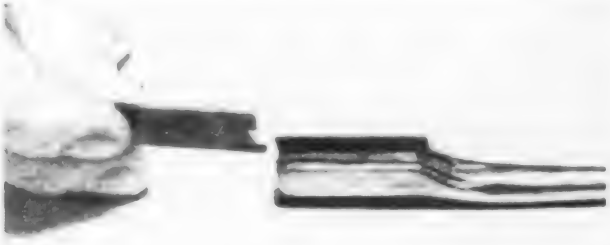

Double Blade Cutter To Mount Prints

A SIMPLE and neat method of mounting snapshots is shown in the accompanying illustrations. Using a ½-in. square bar, hammer out handle and offset one end to shape as shown. Saw two slots lengthwise and $\frac{3}{16}$-in. apart in the offset end and insert a strip of tin slightly thinner than a razor blade. Then hammer sides so the grooves fit snugly. When the tin strips are removed, the razor blades should fit exactly.

Electrical Engineering

[*Continued from page* 132]

and small plants whose total dollar output ranks near the top of American industry.

Sales Engineer. Here is a lucrative branch which appeals to the man who has a thorough engineering knowledge of his company's products, but who would rather deal with people than make plans and computations. There's nothing of the door-to-door canvassing in his job—he sells to big buyers who can only be handled intelligently by a man who, in addition to sales ability, knows all the answers to engineering questions about his product.

Application Engineer. A broad knowledge of industry as a whole is needed by the application engineer, whose job it is to recommend the proper machines to solve the problems of a given industry. If a public utility wishes to step up its power output, the application engineer must figure out the type of equipment needed, calculate how overhead can be reduced, efficiency increased, and see the job through until satisfactory installation is made. Naturally he has to have a thorough understanding of his customers' problems.

Consulting Engineer. He is the freelance, usually a specialist in some field whose advice and supervision is purchased for a fee, just as diagnosis and prescription are dispensed by a doctor. The consulting engineer usually hangs out his shingle only after he has been through the mill and has demonstrated his ability to deliver practical as well as engineering information of the kind people are willing to pay money for.

You can go on and break down electrical engineering into scores of other sub-classifications, but right here you may very pertinently ask:

"How about electrical jobs that don't immediately require a fancy knowledge of mathematics, or a college degree—something a fellow can earn money at while he's preparing himself for the next step up the ladder? Aren't there any jobs like that?"

Very definitely, yes. That brings us right up to the question of how a young fellow can get electrical education. If your score on the aptitude test isn't quite high enough, yet, to encourage you to go in for straight engineering, there are other training facilities that will fit you for a congenial job in this constantly expanding field. Don't let anybody tell you it isn't expanding, either. The dollar volume of the electrical industry is way ahead of the golden year of 1929—pre-depression. One company alone (American Telephone and Telegraph) has spent an average of one million dollars a day on plant construction!

The engineering college stands at the top of the engineering field. There are 150 colleges which grant engineering degrees and you are pretty sure to find a good one in your vicinity. Your Board of Education will help you here, and, also in recommending other types of training schools. There are, of course, the "Tech" schools which teach engineering subjects exclusively. Courses leading to an engineering degree require four years to complete. Costs vary. A state university will charge less tuition than a tech school. On the average, you should be prepared to invest at least $500 a year plus living expenses.

Close kin to the engineering college is the special type of technical school which gives an intensive, directly practical electrical training in one year's time. It is really a condensed engineering course for men who can't take full college training. You get practical mathematical training, through trigonometry; drafting, testing, installing, inspecting, and work on all types of electrical equipment in common use. Such a one-year course in one widely recognized school costs $850, which covers tuition, books, and room and board.

Since so much engineering training is pure "book learning," the subject lends itself well to study by correspondence, especially by the man who is employed in some electrical job but who wants to invest his spare time in climbing farther up the ladder. The subjects are comparable to those covered in college, and take about the same time to complete—40 months is one school's average. The cost is considerably less—$250 for one representative course.

Outside of engineering schools you will find somewhat less emphasis put on *higher* mathematics, such as calculus. If you can creditably complete a mathematics course through trigonometry, you will be able to handle three-fourths of the work that comes to an electrical engineer. As in any other job, most of the daily problems are routine. Naturally, trigonometry is tough enough unless you have sound mathematical sense.

The education which fits you most quickly for an electrical job is offered by technical schools which give you practical training in 12 weeks' time. Theory is passed by in favor of practical experience, working directly on machines under the supervision of experts. You are equipped to start an electrical shop of your own, to do repair work, to service and repair equipment—basic practical training which will open up a vast variety of skilled jobs to you.

Such training is admirably supplemented by good textbooks which fill out the "holes" in one's training. Books covering every conceivable phase of electricity are available to anyone at reasonable cost. Indeed, the man who operates under his own steam (and that is one characteristic of an engineer) will find this a particularly congenial method of study.

In many communities electrical training is given

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Electrical Engineering

[*Continued from page* 134]

in high schools and trade schools. Some corporations run their own training schools. The one thing common to all types of electrical education is emphasis on positive knowledge. A man working in the electrical field has his own life and the lives of fellow-workers dependent on his care and caution. Possession of an engineering degree doesn't mean, of course, that your education stops—unless your progress stops too. Through books, technical journals, and experience you keep on learning until the end of your days.

"With all this unemployment, what chance do I have of getting a job after I invest a lot of time and money in education?" you ask.

There are a number of reasons why you stand a mighty good chance. If you have the intestinal fortitude to finish an electrical course, you're miles ahead of the casual jobseeker because *you know what you want to do and you have the training to back it up.* Any personnel manager will tell you that the bane of his life is the hopeful applicant who, when asked what kind of a job he thinks he wants, replies "Just anything." "Just anything" is the practical equivalent of "nothing." The trainihg you acquire will, itself, suggest a vast number of places, in big industry and small, where your talents—*needed* talents—can be put to work. It is easier to place a skilled technical man than a Bachelor of Arts or Doctor of Literature.

The electrical school you attend, whatever its classification, will almost certainly have an employment service to help you land a job. No reputable school will guarantee a job, but a good many have records of placements which is tantamount to a guarantee.

Don't think that corporations aren't on the lookout for promising engineering material. Men in technical and engineering colleges are being watched. One gigantic corporation (General Electric) has two staff men whose sole duty is to go over the scholastic records of engineering students and offer jobs to men who appear to be good material. Industry is actually on the hunt for qualified men!

"We check up on grades first of all," said one of these talent scouts. "Good grades mean good intelligence—that a man knows his stuff. But personality qualities are important too. Teamwork, cooperation, good impression—if a student's human side stacks up well along with his marks, he gets an offer of a two-year contract at the plant."

During this two-year period he determines, very largely, how far he is going to progress in his chosen field. He gets practical experience, and if he keeps on learning the sky is the limit. Perhaps it is clearer now why certain character qualities were stressed in the aptitude test.

Big corporations and public utilities absorb a

[*Continued on page* 136]

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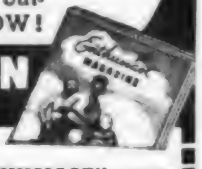

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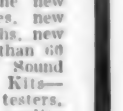

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Electrical Engineering

[*Continued from page* 135]

vast number of trained men, but small industry is important too. There are 1,600 concerns manufacturing electrical products, some big, some small. Electrical service and repair, installation, testing, inspecting, drafting—these too absorb their thousands. There is very little likelihood, if you really know your stuff, that you won't be able to land a satisfactory job. You're *equipped;* you have something definite to offer that the untrained man can't match.

Electricity is a back door—very often, a front door—into any number of active industries. Aviation? Electricity is the heart of a modern plane. Diesel? Streamlined trains, small power plants, hundreds of other Diesel applications, are just as much electrical as Diesel. Refrigeration, air conditioning? These thriving fields are basically electrical. The list is endless.

The possibility of going into business for yourself should not be overlooked. The electrical engineer can set up as a consulting engineer, or as an electrical contractor, after he has acquired experience and capital and demonstrated his abilities. The electrical technician, with small capital, can set up his own service shop, sell and service household or factory equipment. When you go into business for yourself, you naturally have to have an ability to deal with people, and average commercial aptitudes already discussed in this series, but unless you're a consulting engineer you won't have to worry much about mathematical aptitude. The jobs you handle will fall into familiar patterns that don't require the calculating abilities of a designer.

There remains, in this bird's-eye view of a field so vast that we can't possibly cover it in full detail, the important point—"How much money is there in it?"

If you're one of those promising engineering graduates scouted by a big corporation, as just described, you'll be offered $25 a week to start. The dollar value of the education you complete on the job can't be estimated, but it's plenty high. On a very conservative basis, you can reasonably expect to earn $50 a week after five years' experience, and ten years after graduation you should be making at least $300 a month.

In fact, the average incomes of several thousand electrical engineers, studied by the Engineering Foundation, gave $4,000 a year as the ten-year expectancy figure, increasing about $1,000 a year for each additional five years' experience. The complete figures are published in the chart on this page. If you rank in the top half of your profession, you'll be making $5,500 a year after ten years, and in fifteen more years you'll expect to make $11,000. As they say on Broadway, "That isn't hay."

It is true of most "brain" jobs that income and security *increases* with age, instead of diminishing after forty as is true of many fields. As an engineer you won't reach your maximum earning power until you're 55, and income won't drop until you're in the sixties. The stuff you pack into your head is far and away the most dependable form of social security.

What if you start in an electrical field other than engineering? About the least income you can expect is $15 a week as a totally untrained electrician's helper. What you learn on this job, or in a plant, or through books or spare time study, can well qualify you for a job equivalent to that of a lineman for a power or telephone company. Income here ranges from $75 to $150 a month, the latter figure being reached as you become a troubleshooter or service man. As chief electrician of a small factory or power plant you'll draw down about $250 a month. None of these jobs requires much mathematical ability but they do emphasize practical experience.

Unless you go in for some rare specialty, you can find plenty of electrical opportunities right where you are. Manufacturing is largely centralized in the east, but there isn't a single community of any size that isn't largely dependent on electricity. All the experts agree that, amazing as has been the advice of electricity in this century, its possibilities have hardly been scratched!

Income Chart for Electrical Engineers

Electrical Technicians:		
Electrician's helper, untrained	per week	$15
Public utility linemen	per month	$75 to $150
Troubleshooters and comparable electrical jobs	per month	$150
Chief electrician, as in a power plant or private business	per month	$250 up
Electrical Engineers:		
Beginners, first job after graduation from engineering course	per week	$25 to $30
After four or five years' experience	per week	$50
Reasonable minimum after ten years	per year	$3600

The above figures indicate what the electrical engineer of average qualifications can reasonably expect as minimum income. Figures compiled by the Engineering Foundation show that the probability of greater income is very good. The young engineering graduate earns from $1500 to $1800 a year during the post-college period when he is getting practical experience that to a large extent determines his future earnings. Significantly, an engineer does not reach his maximum earning power until the age of 55, and there is no average decline in earnings until he is in the sixties. The income experience of engineers as revealed by several studies by engineering associations reveals this earning chart:

Average incomes of all the engineers studied (annual)

After 10 yrs. experience	After 15 yrs. experience	After 20 yrs. experience	After 25 yrs. experience	After 30 yrs. experience
$4,000	$5,000	$6,000	$6,500	$7,000

Average annual incomes of the upper half of group studied

After 10 yrs. experience	After 15 yrs. experience	After 20 yrs. experience	After 25 yrs. experience	After 30 yrs. experience
$5,500	$7,000	$8,000	$11,000	$14,000

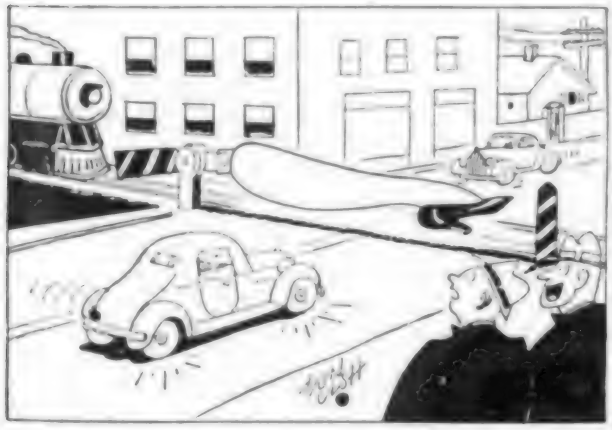
Correct Answers to Quiz on Page 65

1. False. Cocobolo is a tropical American timber tree.
2. True. Gooses are a type of iron used for pressing.
3. True. An insect (Tachardia lacca) attaches itself to certain Indian trees and produces a scaly covering from which shellac is made.
4. False. The coral snake lives on land.
5. True.
6. False. A cowsucker is a harmless North American snake.
7. True. The animal is so named because of its eating habits.
8. True.
9. True. His name was originally John Paul. He adopted the name Jones later in life.
10. False. Aspirin is the acetyl derivative of salicylic acid. Trinitrotoluene is commonly known as T.N.T.
11. False. A Western Union Splice is a wire connection.
12. True.
13. False. A typhoon is a tropical cyclone.
14. False. A thesaurus is a type of dictionary.
15. True. The camshaft, valves, and some other parts are eliminated.
16. False. A propeller spinner is a small hub or fairing on a propeller.
17. True.
18. True. Some sloths have two toes on their fore feet and three on the hind feet. Others have three toes on all feet. The neck vertebrae vary from six to nine.
19. True. Devices of this type are being currently used on sailplanes and dive-bombers.
20. True.
21. False. Whippletrees are articles of harness.
22. False. The purpose of filters placed over the lenses of cameras is the achievement of certain photographic effects.
23. False. Grid leaks cannot be caulked.
24. False. Sal ammoniac is ammonium chloride.
25. False. A porringer is a bowl.

Attention, MI Readers!

We will pay $1 for each true-false statement which we find acceptable. Statements will not be acknowledged or returned. Address the Quiz Editor, MECHANIX ILLUSTRATED, 1501 Broadway, New York City.

Checks have been sent to the following: Leonard Williams, Minneapolis, Minn.; Claude Kramer, Atchison, Kan.; Frank McAneny, Shreveport, La.; Andrew M. Lavish, Washington, D. C.; J. B. Mallory, Saint Charles, Mo.; Forrest Carter, Baltimore, Md.; Joseph Hurley, Dorchester, Mass.; Richard Scudder, Bowling Green, Ky.; J. Slater, Quebec, Quebec; Richard Nichols, Endicott, N. Y.



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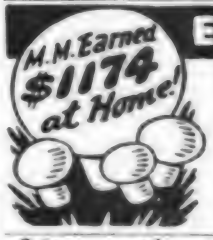

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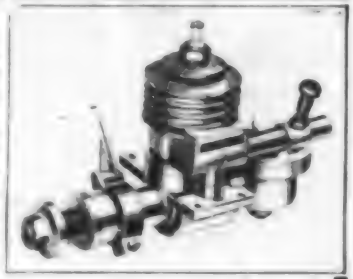

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Trapping The Fires Of Hell!

[*Continued from page 71*]

000. Mines had to be abandoned, although there was still minable coal in them. Several large coal companies tried to put out the fires. When a creek was diverted into the fire, the steam generated caused a major cave-in and the inrush of air only fanned the flames higher. When a concrete barrier was built the hot coal cracked it and the fire went on its destructive way, leaving the ground above green and sterile from the acrid, poisonous fumes.

There's a story of explosion, cave-in, or wells running hot for every familiar landmark: Cobbler's Knob, Cow Hill, Goose Run, Plummer Hill.

Prohibition officers knew Plummer Hill too. Bootleggers used to go down an airhole into "Moonshiners' Slide" and come up two miles away in Hocking County, laughing at the officers who waited in vain for their return. Oaken barrels were placed in underground streams of hot water for rapid seasoning—at least that's the story—and the labyrinth of tunnels and fissures made capture virtually impossible.

Yet the fire for all its mischievousness, all its destructiveness, wasn't as dangerous as many another mine blaze. A Silesian coal mine in Germany burned a few years after the start of the Ohio "inferno," and 104 miners perished. In 1909 the Cherry Mine disaster in Illinois took a toll of 259 lives when a torch set fire to a load of baled hay at the bottom of a vertical shaft.

The most ironic disaster of modern times occurred barely a dozen miles from New Straitsville one day in 1930. A group of mine safety engineers were making an inspection of a coal mine at Millfield, Ohio, when a freak explosion trapped 160 miners, and killed 83, including the visiting inspectors. Wild rumors floated through the coal towns; one whispered that a creeping offshoot of the great mine fire had touched off the fatal explosion. Experts scoffed, but the catastrophe focussed attention once more on the problem of extinguishing the half-century old fire. In 1934 FERA engineers made surveys, plotted the battle against the raging inferno.

Residents in the blighted district cheered when they learned the Federal government had appropriated $365,000 to dig tunnels and ditches and throw a monster barrier of mud and clay around the fire. Unemployed miners dusted off their lamps and promised their children good food again. Engineers from the U. S. Bureau of Mines and the State Department of Mines worked at surveying, drawing maps, exploring old tunnels.

A comprehensive safety program was worked out, and James R. Cavanaugh, veteran mine firefighter who directed the work, was able to boast that not a single life was lost in the sealing project . . . a safety record in a dangerous industry that has an annual death toll of more than a thousand men. Because of the nature of the work, only single tunnels were driven in most cases; usual mine safety practice requires parallel tunnels for ventilation. At some places the men were working 200 feet underground.

The Plummer Hill Barrier, completed first, was 640 feet long. The tunnel, bored through the coal veins, lay in the path of the subterranean fire like a small-scale Maginot line. Every hundred feet holes were bored from the earth's surface and wet, slimy mud was poured into the excavated area. Flanking this is the Lost Run Barrier, 5,000 feet long, zig-zagging in the path of the fire. A trip underground along its length would have revealed a dark tunnel, 12 feet wide, specked with the yellow lights of working miners. On each side the coal seam, 4 to 12 feet thick, glistened dully. Where old workings were utilized the side tunnels had to be sealed with stone and clay.

Greatest of all is the Shawnee barrier, a mile and a quarter long. Mine experts spent a few tense weeks at the end of the job when the fire burned close, but the tunnel was driven and filled with mud before the flames could burst through.

Filling the tunnels was a dangerous job, for braces of wood, and even the usual coal pillars, had to be removed first . . . nothing combustible could be left. Every foot of barrier had to be inspected underground to prevent air pockets.

Adam Laverty, the operations engineer, began the project exclusively with hand labor. Three hundred and forty men with picks, shovels and wheelbarrows were eventually aided, however, by steam shovels, dynamite, mine railroads, and electric pumps to keep the tunnels drained. The cost mounted to nearly a million dollars. The coal that was taken out was distributed to local relief clients.

Early in the spring of 1940 the project was completed, check inspections of the mud barriers were made, and the engineers' office closed up. Inside an area of 30 square miles the fire was held prisoner by the network of tunnels and mammoth ditches. Outside, 28,000,000 tons of coal are safe, for engineers had estimated that the fire, unchecked, would have eaten its way forty miles south to the Ohio River in 200 years, destroying the whole Hocking Valley coal field.

The gray craters, some of them still smoking, continue to dot the hillsides. Flames can still be seen. The gaping cracks in the earth still yawn, a menace to life and limb. The vile, sulphurous smell continues to be a familiar annoyance to Hocking and Perry County residents. But there's a new hope there now. The fire's been cut off, given only a year to live if plans work out.

Science has put a wall around hell!

California leads the states in motor vehicles per capita: one to each 2.4 persons.

Flying Battlesnake

[*Continued from page* 51]

large bore cannon. An advantage of this type of construction is the absence of armament firing limitation. This results from the fact that no synchronization is necessary as the guns do not fire through the propellers, but between them. The armament may be varied according to the demands made on the plane by various fighting conditions. Ten machine guns can be substituted for the two cannon if desired. To add to the potency of this veritable flying armory, bomb racks near the wing tips enhance its power for land attacks.

The XF5F-1 is intended for operation from aircraft carriers, a use requiring the utmost in performance. The bombing plane, one of the major foes of the aircraft carrier, is an easy prey for this deadly aerial duelist. Within 30 seconds of the appearance of a bomber, the Skyrocket could reach an altitude that would require five minutes for many planes. Within three minutes it could climb to the vicinity of 10,000 feet for an attack on the bomber—with two cannon—or perhaps ten machine guns.

An exceptionally large fuel capacity makes the plane invaluable for bomber escort service, a long cruising range being necessary for such work.

Fingerprints Feel The Touch!

[*Continued from page* 59]

men—she has many masculine students—but she considers the work a "natural" for Miss America. Women experts are accurate and patient, and their presence in the field removes from fingerprinting its underworld stigma.

Many of the girls are trained for careers in industry, helping to prevent payroll and similar frauds. Fingerprints, they point out, cannot be easily forged. Other students prefer hospital work, or courses in fingerprint teaching. The simplest study of all, chosen by many high school youngsters, is an introductory course in the taking, classifying and filing of prints. The most advanced work is the three-year scientific research course, featuring such bizarre items as the study of the fingerprints of museum mummies. All in all, there are ten courses, including a special class in fingerprint work for Social Security Unemployment Insurance.

A novel woodpecker problem was recently reported by a California citrus grower: He had to repair an airplane used in spraying groves because a woodpecker pecked a hole in a propeller blade, and unbalanced the blades.

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Boat Bottoms Hit A New High

[*Continued from page 57*]

within a pound or two (as nearly as we can determine) of being the same.

"Another important element," McCullough said, "was to gain the benefit from the air pressure under the hull, which is one of the main factors in decreasing water friction. Air under the hollowed hull in your three-point job will come into effective play at about 40-miles per hour, as a decidedly buoying factor."

Although practically every inboard race boat to break speed records in the past two years has used principals of three-point-suspension, no hull to date has completely "measured up" to the potential peak performance of the motor.

After Sir Malcolm Campbell turned the fastest mile a motorboat has ever traveled, on England's Lake Coniston last August, in his Rolls-Royce powered 2,600-h.p. *Bluebird*, at 141.74 m.p.h., the gray-haired Scotch speed-king observed that "there are several miles an hour more in the old girl." At no time during the run, in which he had hoisted his own unlimited record by almost 12 miles an hour, had Sir Malcolm held the throttle wide open.

Likewise, when Lou Fageol, San Marino, California, driver recently traveled 98.819 m.p.h. to break the statute mile record for boats of 732-cubic inch motor displacement with his Gold Cup racer, *So Long*, the driver said that his engine was not turning within 500 r.p.m. of her peak.

Nonetheless, speeds attained by these record boats, or by virtually all others which have made straightaway or competitive marks would have been virtually impossible had the hulls been of the conventional design of the record holders a few years ago. It is of note that the entire hull of *So Long*, and the bottom of the *Bluebird*, was designed by the "daddy" of successful three-point-suspension advocates, the noted Arno Appel, of the Ventnor Boat Company, Ventnor, New Jersey. Although *So Long* is smaller, there is no discernible difference in the bottom plan of either of these two famous boats. Ventnor's three-point hulls boast a longer chain of records and race triumphs than those of any other builder.

An important factor which will presumably inspire designers to hasten development of hulls that are as nearly capsize-proof at high speeds as is scientifically possible, is the "drivers' angle."

In this keenly competitive sport today—throughout the world it has been computed there are nearly a million active participants in motorboat racing—speed remains the Alpha and Omega of drivers. They dare not sacrifice it. On the other hand confidence is a vital asset in winning races. A boat which does not handle and is "tricky" will soon get even an experienced driver to a point where he can't drive to the best of his ability. A spill or two and, even if he escapes injury, confidence is gone. He becomes a driver "afraid to mix it" at a place where superior driving often wins boat races—on the turns.

Because of this, many expert observers believe that in future racing the conventional-type hulls of yesterday will be as obsolete as the gramophone. A hull which was safe at lower speeds, becomes an unmanageable, dangerous contraption at higher speeds.

Three-point-suspension hulls with the "perfect balance" designers expect soon will materialize, are answering the cry for boats that will adequately handle the speed potential in the motors they house. Further development also of the safety chine will prevent record race boats of tomorrow from becoming death traps.

Racing authorities admit that the perfect happy medium in design is yet to be achieved, but when this is accomplished, no less an authority than Arthur L. Bobrick of New York and Los Angeles, veteran member of the National Racing Union at Brussels, Belgium, says:

"It is hard to say just how far records on water will go. It is certain that the best speeds achieved thus far will be shaded by many miles per hour in all classes. The boat has yet to be built which will combine the peak in maneuverability and speed. To achieve this does not seem impossible now. The records of the past year or so have proved conclusively that so-termed three-point-suspension will be the answer to undreamed of speeds in racing boats of the near future."

Midget Model Racing Boat

[*Continued from page 91*]

sturdy hull of minimum weight is possible.

Paint the model with colored lacquer, sandpapering after each coat has dried. The number of coats applied will depend upon the color chosen and the finish desired.

Before painting, however, note that two hooks are placed at the stern of the boat and used to hold the rear portion of the motor enclosure or turtleback. A wire stud holds the front end.

The wiring hook-up is of the orthodox design recommended by engine manufacturer. The motor may be started by wrapping adhesive tape around the flywheel. If the flywheel is of the slotted type a leather thong is used. Incidentally, the size flywheel and propeller used depends upon the engine—therefore heed the manufacturer's specifications in regard to these two items if maximum speed and efficiency is expected.

Full-sized blueprints for *Porpoise* are available for $1.00 postpaid. Address Fawcett Publications, Inc., Greenwich, Conn., enclosing check or money order. Blueprint No. 322.

X-ray machines can inspect foods packaged in cardboard or even in thin wood.

The "LF-5"

[*Continued from page* 96]

the loud-speaker to balance the appearance of the front panel, is a great convenience when it is desired to silence the "LF-5" momentarily, while you are tuning in an airplane signal on the short waves. It simply cuts off the plate voltage, leaving the heaters of the tubes on. The entire receiver is turned on or off by means of the knob of the volume control R10.

It was found, while testing the "LF-5" receiver in different locations, that image interference might be bothersome in certain places. This usually shows up in the form of broadcast stations weakly heard on the high frequency end of the dial. If the station is a powerful local, the easiest way to get rid of it is to use a wave trap that will tune to the frequency of the interfering station.

Experiment showed that the trouble could be greatly reduced by altering L2 as follows: Remove 100 turns of wire from each of the three sections. Two of these are wound with "litz," a multi-strand wire, and care must be taken when reconnecting to solder all these strands to the proper lugs. Coil 1-2 on L3 must have 70 turns removed, also.

These inductances must now be paralleled with padding condensers to bring them back to the proper frequency range. Condensers marked X, Y, Z in the diagram do the job and are parallel across the condenser stator sections. These trimmers may be seen atop the variable condenser, and are all of the 50 mmf. maximum variety.

In extreme cases, an aluminum shield over the tuning condenser and L2 might be required, but this is unlikely. At any rate, the receiver should be tried out first with the coils as they come, and in the case, before the above alterations are attempted, as the changes will not be required in most locations.

Since the ground control stations all use rather low-power transmitters (15 watts), it is a good idea to provide the "LF-5" with a long aerial. A single wire not less than 50 feet is recommended; if the available space permits, use 150 or even 200 feet. Leave this aerial connected permanently to the "LF-5", and use a separate aerial for your short-wave set, so that you can tune in both low and high frequency stations without interference.

Insects are not likely to overwhelm mankind, says a Harvard biologist, who finds evidence for the view that the insects have passed their peak of development and are already on the road to decadence.

Farm animals are being taught to use flytraps for summertime comfort: the animal passes through a cage and canvas flaps brush off the flies.

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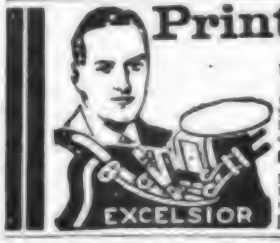

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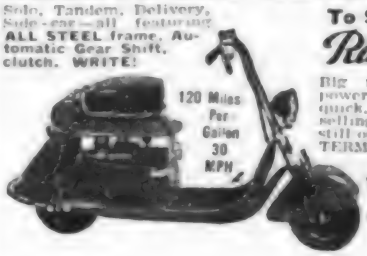

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The MI Soapbox Racer

[*Continued from page* 105]

wheel is suggested. If one cannot be found 12 in. in diameter, cut off the arms of an auto spider and turn up a rim of hardwood on a lathe. Use mahogany, maple, gum or walnut, and glue and dowel the stock as shown in Fig. 9. The hand-brake is made exceptionally strong, with plenty of leverage. Weight of the long lever will keep it off the pavement normally, but a coil spring may be added for further insurance, Fig. 10. The shoe is simply a section of automobile tire, riveted or screwed to the 2 x 3 in. arm.

Larger diameter wheels than the 12-in. standard balloons can be made by gluing and doweling wood disks together (Fig. 11), inserting a steel hub of the dimensions required for ball bearings and having the local bicycle dealer fit on solid tires, preferably with a narrow tread. This type of wheel could be made 15 in. or more in diameter, and properly trued up, is quite speedy.

The body design invites your best work. It is possible to make a clean-cut job by careful fitting of joints, filling seams with wood putty, and giving a first-class paint job. You can make it look like one continuous steel body. Profile is given in Fig. 12. Sides are continuous pieces of plywood or hard pressed board, while radiator, top of hood, cowl and top of rear deck are built up of laminated white pine, which is easy to work. Assembly is shown in perspective in Fig. 13. The body framework may be held together with screws, or with nails and casein glue. Side panels must be screw-fastened. Use flat head screws and turn them in flush with the plywood surface, or slightly below. The screw heads may then be puttied and sanded off so they do not show. Note that this is designed to slip down snugly over the chassis frame, and is secured with three bolts. Sections through hood and rear compartment are illustrated in Fig. 14, together with the instrument board, on which dummy instruments can be installed. When completed, an interesting and arresting color-scheme would be a light canary yellow with red wheel disks—or black disks with a red stripe.

Large scale blueprints for the MI Special Soapbox Racer are available for $1.50 postpaid. Send check or money order to Fawcett Publications, Inc., Greenwich, Conn.

Lacing Will Repair Paddles

[*Continued from page* 93]

years to the serviceable life of the paddle by lacing the split with a good grade of mason's chalk-line. Bore or burn small holes along both sides of the split and give the whole paddle a coat of marine varnish to prevent the cord rotting.—*S. S.*

Nautical Lamp

[*Continued from page* 99]

shoulder at the top, to a point 1" from the bottom, against which the rope is secured. Bore holes at the top and bottom of the base to take the ends of the rope as shown in the drawing. After turning the base, leave it on the lathe and coat the depression around the sides with a good grade of glue. Glue one end of the rope in the top hole and wind the rope around the base tightly, taking care to collect any slack and keep the rope taut. Glue the lower end of the rope in the lower hole. Bore a hole from the top of the base to a point near the bottom and another hole at an angle to meet it as shown, to take the light cord. Fasten a switch socket in place. Finish the base and rope binding with clear lacquer, or if you prefer, leave the rope natural. If a bridge type lamp shade is used, you will need a wire clip attached to the center of the shade bracket, so it will slip over the light bulb bringing the shade to a proper height. If possible, buy a lamp shade with a ship motive or anchor design in keeping with the rope bound base.—*G. E. V. H.*

Toy Tea Set

[*Continued from page* 96]

pieces in the upright position. Each leg section consists of two legs, with a crosspiece nailed or screwed to the tops of the legs. The crosspiece is $1\frac{1}{4}$" square and $11\frac{1}{2}$" long. Each leg is finished 14" long, tapering from $\frac{3}{4}$" at the bottom to $1\frac{1}{4}$" at the top. Brace each pair of legs with a $\frac{1}{4}$" dowel glued in place as shown. Attach the leg sections at each end of the top, using two pairs of cabinet hinges fastened with screws to the underside of the table top and to the inner edge of the crosspieces. By pressing down the ends of the plywood locking strip, they slip under the crosspieces, permitting the leg sections to fold up against the table top.

Pieces of plywood are cut out and assembled with small finishing nails as shown, to make the carrying case. Use small brass hinges at the bottom, and suit-case fasteners attached with small screws at the top. An old suit-case handle, or one made from a leather strap, can be attached with brass strips as shown. The $\frac{1}{2}$" squares, used in the diagram, show the dimensions for the turned plates and saucers, made from blocks $\frac{1}{4}$" thick, and the tea-pot, creamer, and sugar bowls turned from 4"x4" and 3"x3" pine blocks. The spouts and handles of the pots and cups are whittled by hand and glued in place.—*G. E. V. H.*

Canned tomatoes can be greatly improved in firmness by adding a tiny amount of calcium chloride, chemists report.

Listing 11 kinds of milk, the Department of Agriculture reports that reindeer milk is richest.

Table Top Tripod

[*Continued from page* 81]

They are spaced approximately 1½ in. from center to center and are kept even by the circular pencil line under them which is scribed ⅝-in. above the bottom of the egg.

The ⅜-in. dowel legs are 9½ in. long and enter the wood 1¼ in. They have a base spread of 9 inches. Use a ¼-in. drill, instead of a wood bit, for drilling the holes straight in for about ⅛ in. Then angle the bit toward the sharp corner of the opposite side of the top until a depth of 1¼ in. has been reached at the shallowest part. This will give the correct angle to the legs. Wrap a piece of rubber inner tube around the egg to avoid marring and hold upside down in a vise when drilling the holes, as it is comparatively easy to get the right angle when this is done.

The ⅜-in. dowel legs are first dressed down with sandpaper to about 5/16 in. and later waxed for a finished job. The legs should be fitted snugly to the ¼-in. holes in the body.

Rubber headed thumb tacks are driven evenly into the bottom of the legs before assembling and turned down on an emery stone to a size slightly larger than the wood legs.

The tail piece, if not substantially solid in the egg, should be glued in or pinned and the lower part turned or cut down to a size ¼x⅝ in. to fit the opening of a door knob. The door knob is filled to about one-inch of the top with lead for a counter-balance. A nickle plated or chromium plated knob with set screw is preferable as it looks better. The set screw holds the knob firmly to the tail piece.

Auto-Spring Crossbow

[*Continued from page* 84]

a manner that only the split quill shows. To this apply the cement and press against the arrow, holding it a moment for the cement to dry and harden. Each arrow requires three such feathers and they should be set at an angle of 120 degrees from one another.

The arrow tips are of two types, hunting tips and target tips. The former are of steel, sharply pointed and barbed. The latter are simply brass caps that fit over the end of the arrow. While both are obtainable at stores carrying archery goods, adequate tips are easily made by driving a light nail into the end of the arrow with the grain, forcing a piece of light brass tubing over the arrow and far enough down so that a little of the wood is visible in front, cutting off the nail's head and bringing the whole to a sharp, symmetrical point with a file. Such a tip will pierce a target consisting of a circular, straw-filled cloth cushion, or a target of heavy cardboard.

The only insect known to invade and damage telephone equipment indoors is the fire ant, reported troublesome in Texas.

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Plywood Lawn Bowling

[*Continued from page* 113]

paulin around the stakes, to which the canvas is stapled after being drawn taut. In front of the back-stop place the triangular platform. Make this 4' along each side, cutting it from plywood, or nailing matched lumber together with cleats across the bottom. Paint a small circular mark for each of the ten pins on the platform. Dig out a triangular bed in the sod for the platform and set it in place, flush with the sod surface, so that the ball will not strike any projecting edge. The base of the platform should be 3' in front of the back-stop. A good flood lamp can be made from a 100 watt bulb and socket, with the extension cord run through the spout of a large funnel, and through a window of the house. Hang the cord over an over-hanging limb of the tree, or from a support formed by a 1"x4" upright nailed to one of the stakes. A crossarm at the top will bring the light over the platform. A strip of white cotton, pegged to the sod with large nails, will do for a foul line. Since the grass will retard the ball, the foul line should not be more than 40' or 50' from the platform. You can determine the best distance after bowling a little.—*G. E. V. H.*

Lathe Clears Bench Top

[*Continued from page* 108]

deal of space so that other work could not be easily performed. I solved this problem by mounting the lathe on a heavy piece of 2x6-in. hardwood with lag bolts. This base was in turn attached to the bench with 2½-in. machine bolts, as shown. When it was desired to use the bench top for other purposes I had only to take the belt off the motor pulley and remove the machine bolt at the right, or tail stock end of the lathe base. Then by loosening the nut on the bolt at the head end about a half turn I could swing the whole lathe and base in a 180° arc, clear out of the way of the bench top.—*W. C. W.*

Accurate Measurements

[*Continued from page* 109]

shown. Simply press down on the apex of the triangle formed and measure the maximum distance between the sides of the protruding butt end. Top right shows how to obtain micrometer readings on stopped slots. Slightly elevate one end of the rod assembly or of the butt above the shaft or plate surface. In using the rod method here be sure that their full diameters are exposed to insure a true reading.—*W. C. W.*

Seed corn dried and hermetically sealed and put in cold storage for as long as six years still has life and power to germinate.

Low Cost Air Conditioner

[*Continued from page* 107]

per hour have been found sufficient to obtain a desirable cooling effect.

Surplus water drains off to the ground and may be diverted to the garden. The pad also serves as a filter to catch dust and foreign matter in the outside air before it can enter the house.

All windows and doors are kept closed, except one on the side of the house opposite the cooler. If an attic opening is available it can be used as an outlet to pass the direct cool-air current through the house, with air changes about every three minutes.

Many builders use motors rating from ⅛ to ½ horsepower. For the same capacity large, low-speed fans are quieter and use less power than small high-speed ones, but cost more to buy and install. The velocity of air passing through the two-inch thick pad should be kept below 200 feet per minute. This can be accomplished by using about two pounds of excelsior per cubic foot in a pad eight feet square.

The attached sketch gives an idea of how to construct your air conditioner. You will find that it pays to use good, lasting materials and clean excelsior. The pad should be easily removable, since to get best results, it should be changed frequently as the constant wetting will occasionally develop objectionable odors in the material.

Some builders have found that the evaporative pad unit can be installed in the cold air duct of a warm air furnace system having fan circulation. To bring in outside air, close the air return register and open the duct ahead of the evaporator so that humidified air will not recirculate.

College authorities trace the "desert cooler," as this device is called, back to the days when ranchers would soak a sheet or other cloth in water and hang it in an open window or door. Today the refined and improved cooler can be found in more than 15,000 farm homes, while some estimates place the number nearer 50,000.

Use of the desert cooler is not limited to farmers, however. At Brawley, California, a large theatre auditorium is cooled by an immense home-made outfit. Several of them are used to cool courtrooms in the Imperial county, Calif., courthouse. Stores, offices, barber shops and even factories also use this same, simple, yet practical and inexpensive means for coping with excessive summer temperatures. In localities where summer humidity is relatively high the system will not work so well, however. It is recommended chiefly for the arid sections.—*H. H. Slawson.*

A "cloverleaf" house for four-families is a novel design evolved by the U. S. Housing Authority, as having advantages over row houses.

An early type of machine gun used in the Civil War consisted of a number of 50-caliber musket barrels mounted in a cylindrical casing.

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New Ideas for Home & Shop

Names and addresses of manufacturers of products described below will be sent free to any reader on request, provided a stamped, return envelope accompanies the inquiry. Mention date of issue when writing.

Four of the most useful household necessities are combined in a new compact piece of furniture which should prove a great boon and labor saver to the busy housewife. A touch of the finger will change the gadget from a step-ladder to an ironing board, or from an occasional chair to a bedside table. This does away with the lugging of individual pieces around from room to room. Photo directly above shows the wooden Jekyll and Hyde in three of its moods.

One man can clean up to 3200 square feet of walls a day by using a compressed air device now on the market. The compressed air feeds a cleaning solution and rinse water from separate tanks through applicators to loosen dirt and remove it.

A new, low-priced miniature twin lens reflex camera for the elementary amateur photographer has been announced by a leading camera manufacturer. It features a reflex type view finder giving a full negative-size image.

Designed to expel the accumulated heat of the daytime and replace it with cool night air, an attractive window fan can be used in place of an attic fan. It will cool three or four average rooms at a cost of less than a cent an hour. Installation takes about fifteen minutes, and the fan will fit either upper or lower sash.